NOVEMBER 1958

PRECISION METAL MOLDING

INCLUDING DIE CASTINGS MAGAZINE

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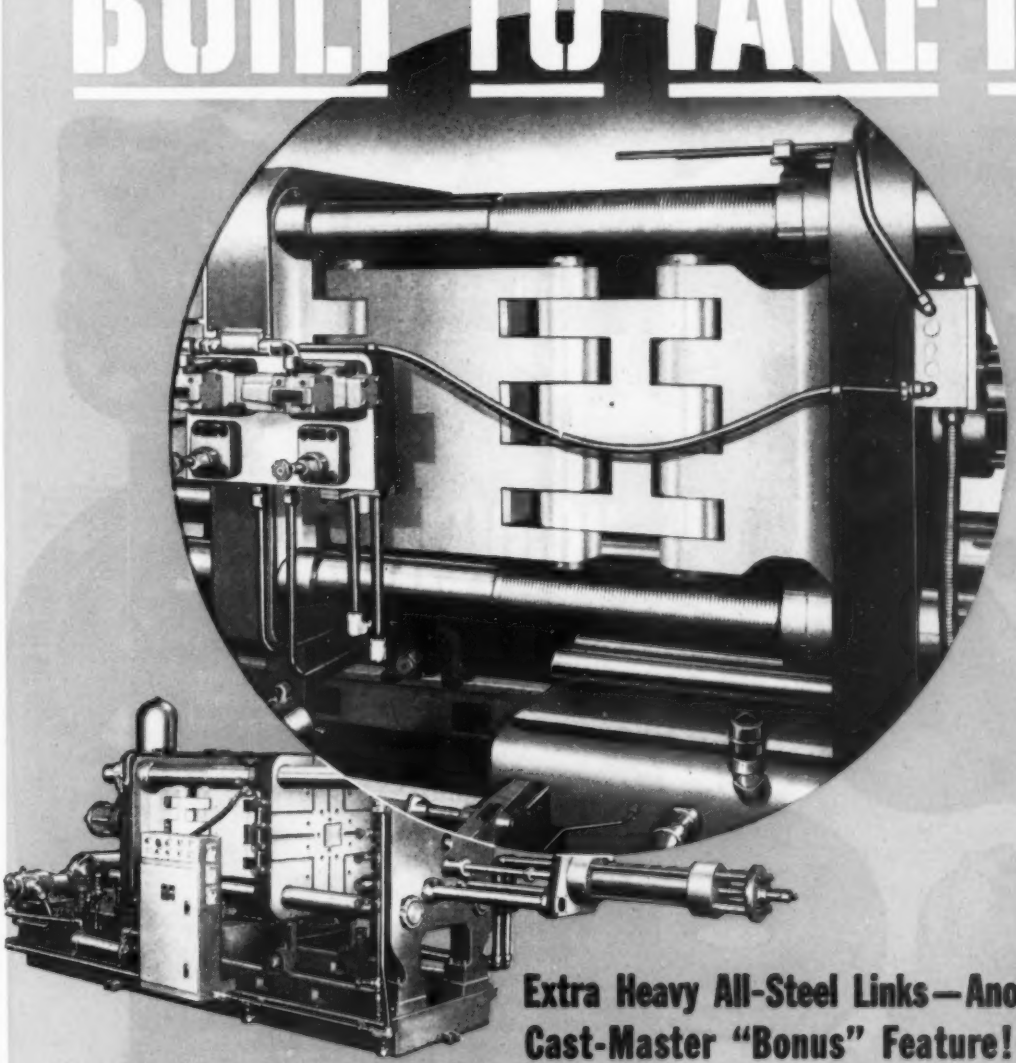

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Vol. 11 No. 11

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LETTERS TO THE EDITOR

POWDERED METAL PARTS vs SINTERINGS

For many months I have read with great pleasure your publication Precision Metal Molding. I am convinced that you and your staff are making an outstanding contribution toward the promotion and development of the acceptance by industry of the products of powder metallurgy.

Your announcement in the August issue of the discontinuance of the use of the term "sinterings" came as a profound shock. Frankly, I feel that your recantation is strictly out of character. After so able displaying the necessary courage and foresight in the adoption of the new term, you suddenly appear to have lost the courage of your conviction.

Conceding the fact that the verb form sintering, long widely used in the industry, is definitely well established and accepted, where is the logic of outlawing the noun form "sintering"? The objection raised by MPA, in my opinion, carries little weight.

I suggest that you poll your readers for their reaction. I am thoroughly convinced that you will find the great majority will enthusiastically support your splendid coining of the new and greatly needed term, "sinterings". — R. W. S.

This has apparently become a controversial matter among practitioners and users of powder metallurgy, judging from the response to PMM's recent return to the use of the phrase "powdered metal

continued on page 6

Minimize the hazards of line breaks...

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Fire Point, °F Cleveland open cup	685
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Pour Point, °C	—25 to —30
Weight, lbs/gal. @ 20°C	9.7

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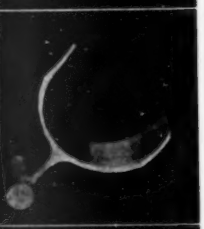
NO. 20 ALUMINUM BRONZE *Atlantalloy*	Excellent for gears and bearings. Strong, light, zinc-free. Highly resistant to corrosion. Machines well.	
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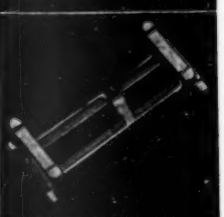
NO. 40 *High Strength* ALUMINUM *"Tenzalloy"*	Attains high strength through natural aging. Free from internal stress and skin hardness. Ideal for machining.	
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LETTERS TO THE EDITOR
continued from page 4

parts". We invite any further comments from our readers, and will refer any such opinions to the proper committees of MPA and ASTM for consideration in adopting nomenclature. — Ed.

DIE CAST TRADEMARK

Enclosed herewith find facsimile of trade mark of a zinc die caster.

It would be greatly appreciated if you could advise the writer the correct name and address of this die caster. — O. L. G.

This inquiry is typical of a large number of similar requests. We have a tabulation of some marks used by die casters and are frequently able to provide identification. In this specific instance, we were able to give the name and location of the die caster, located in the midwest. — Ed.

SHELL MOLDING

We greatly appreciated reading your article on Shell Molding and we are wondering if you could send us the names of foundries using the Shell molding process who would be interested in accepting orders from us for castings in ferrous and non-ferrous metals. — J. R. B. (Supervisor).

Information forwarded—Ed.

LEAD DIE CASTINGS

Officials of this concern read your publication with great interest. We note that after receiving your publication for approximately one year, we have never noticed any information devoted to die casting of lead — J. B. L.

In two recent issues, probably received after the above letter was dispatched, PMM has carried articles on lead die castings. A detailed case history from our British correspondent was offered in August; a survey of types of lead and tin alloy that can be die cast and something about the

continued on page 8

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properties and uses for them, was presented in September.

However, we are always looking around for new and interesting information about how, where and why such die castings are employed and will welcome comments or suggestions. — Ed.

WHO MAKES BRASS DIE CASTINGS?

At the present time we are doing zinc die casting and are very much interested in brass die casting. If you have any literature or information available on brass die casting we would appreciate your sending same. It would also be interesting to us if you could supply a list of companies now doing brass die casting so that we may contact them regarding their producing brass die cast parts for us. — J.A.P.

Information sent. — Ed.

LARGE CASTINGS

Your September 1953 issue contains a letter written by R.R. (superintendent) who mentions that he has plants in Indiana and New Jersey. He refers to precision castings up to 30" in diameter and weights up to 200 pounds.

In your reply to him you mentioned the limitation of size with the usual precision casting processes. If it is possible, we should like to bring to R.R.'s attention the fact that we are making precision castings larger than the sizes he mentioned and would very much appreciate having an opportunity to see what his requirements are. Would you either advise us his name and company or refer him to us? — W.S.M. (Development Metallurgist).

We have put this company in touch with reader R.R. and have amended our data files to show that it is possible to get "precision castings" as large as

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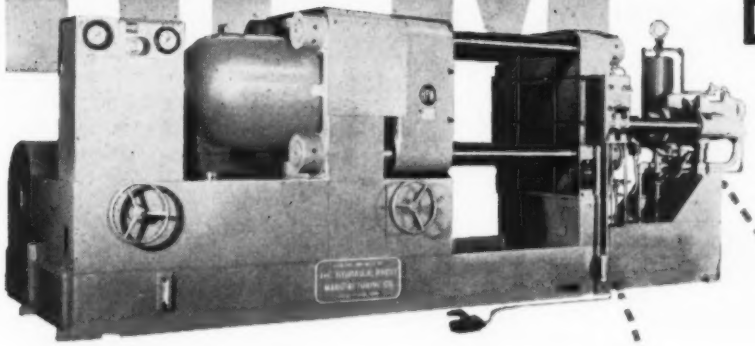
HPM



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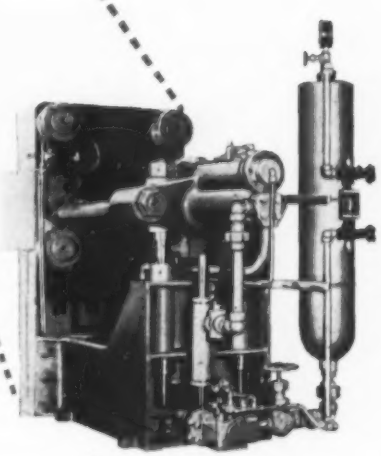

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SIZE OF DIE PLATES	SPACE BETWEEN BARS	DIE OPENS	MAXIMUM DIE SPACE	CAPACITY PER SHOT (LBS.)	NET WT. (LBS.)
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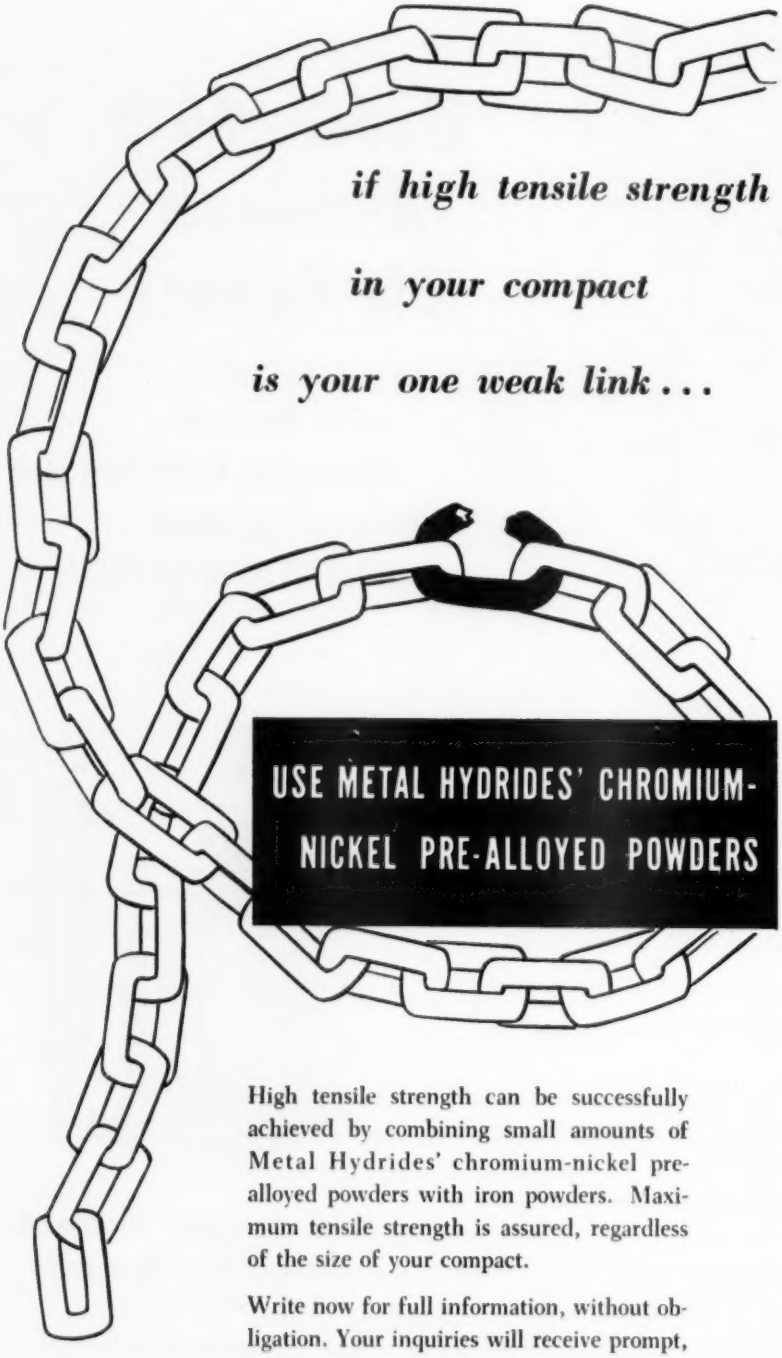

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200 pounds in weight. We would be interested in knowing what order of tolerances are being held and what casting method is being used, since neither wax, polystyrene nor frozen mercury patterns are known to be suitable for investment casting such large pieces. The term "precision" has been applied to such diverse casting methods that it no longer signifies only "investment" casting methods. — Ed.

DIE CAST PIPE PLUGS

Please refer to your September 1953 issue of Precision Metal Molding. We will appreciate receiving your advice concerning a source for the zinc pipe plug 775F as shown on page 48 of this issue.

We are interested in a source for this part in ⅛", ¼" and ⅜" sizes. — W. C. S. (Assistant Chief Engineer).

Information forwarded.—Ed.

BIBLIOGRAPHY OF DIE CASTING MATERIAL

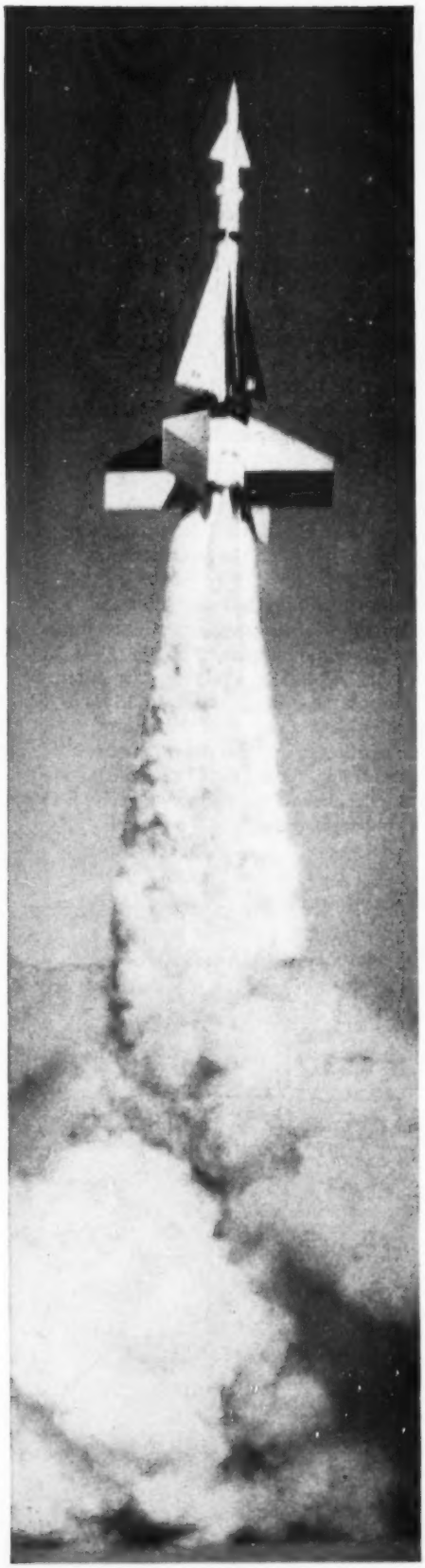
At the suggestion of the American Die Casting Institute, we are writing you for a complete bibliography of die casting material. — N.P.

In 1947, Die Casting magazine published a complete bibliography of die casting for the years 1910-1946. A few copies of this are still available at $7.50 — Ed.

TEAR SHEETS

Please send me tear sheet for reprint of "Shell Molding vs. Conventional Sand Casting . . . Some Dramatic Cost Comparisons" which appeared in the July 1953 issue and also "Mechanized Shell Mold Casting" which appeared in the June 1953 issue. — J. O. M.

We are always glad to send reprints or tear sheets without charge as long as our supply lasts.—Ed.



Photo, Courtesy Douglas Aircraft Company, Inc.

Inco precision cast these gyro gimbal parts for Kearfott Company, Inc., from SAE 8620 steel. The parts are made to a tolerance of plus or minus .005 inch per linear inch and require very little finish machining. The cost of fabrication by conventional methods would have been prohibitive.

What Keeps a Guided Missile on Course?

It's the precision gyro that stabilizes missiles, target drones and jets and keeps them headed true.

These gyros are exposed to temperatures ranging from −65° F. to +203° F. Naturally, the gyros have to be built to operate perfectly throughout this range. So that all the working parts may expand and contract evenly, they must be made of the same metal.

One of the leading manufacturers of these gyros is the Kearfott Company, Inc., of Little Falls, N. J. Kearfott engineers have found that the most satisfactory metal for these parts is SAE 8620 steel.

But to fabricate the gimbal parts by conventional methods would be prohibitively expensive.

That's where Inco stepped into the picture and suggested precision investment casting.

Inco precision-cast the gimbal parts to a tolerance of plus or minus .005 inch per linear inch. The only machining necessary was at critical areas; result—proper alignment and virtually no friction. Then the parts were ready to be drilled for mounting.

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Whenever you have a part which is 6 inches x 5 inches or smaller, weighs under 3 lbs., requires starting tolerances as close as plus or minus .005 inch per linear inch, and needs 5 or more fabrication steps, there is a good chance you can cut costs by having it precision cast.

When you get precision castings from Inco in practically any metal from plain carbon steel to the new super alloys, you get many advantages.

Precision castings may save as much as 60 per cent of production costs. Make possible the use of extremely hard metals. Reduce machine shop bottlenecks. Lead to economies through re-design. Reduce metal scrap. Often permit the use of a higher alloy which otherwise would be too costly. Even make possible designs you previously thought impractical to produce.

For more information, write for a free copy of "A Machinist's Nightmare Becomes a Designer's Dream."

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67 Wall Street New York 5, N. Y.

Inco Castings PRECISION, SAND, CENTRIFUGAL

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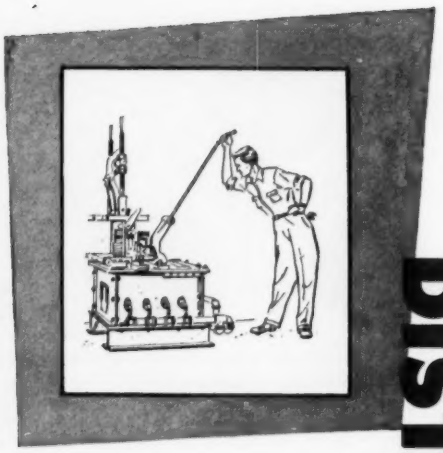
DISTANCE: 200 LBS.



↑ The first practical die casting machine, some fifty years old, now in the Smithsonian Institute, Washington. Weight of its castings was limited to about four ounces.

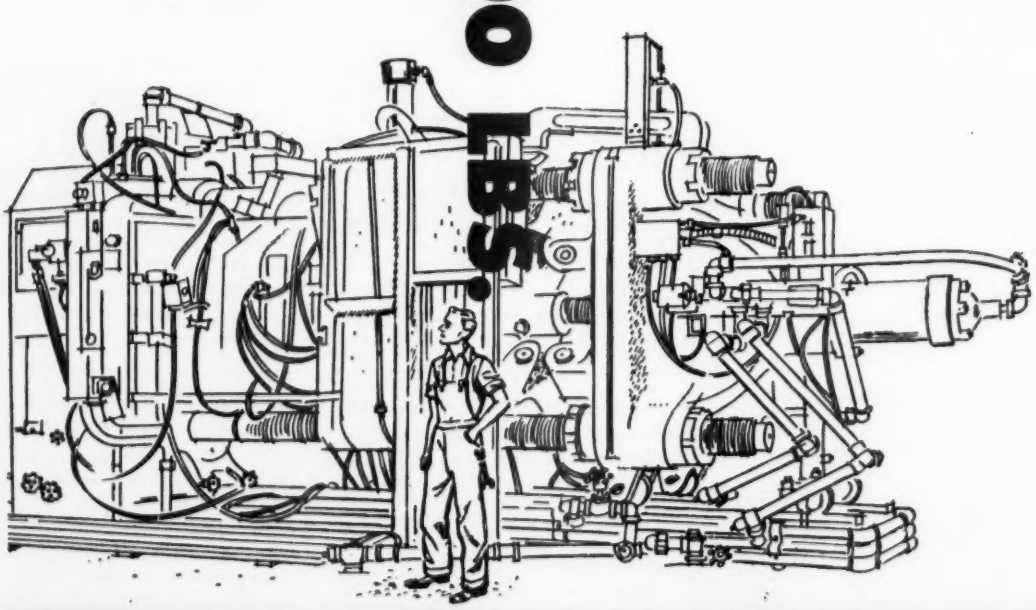
Illustrations courtesy Doehler-Jarvis Corp.

Die castings weighing up to two hundred pounds in zinc can be produced from this modern die casting machine. ↓

ONE WAY OF MEASURING the fabulous advance of die casting as a production tool is by comparing the weight of zinc base die castings produced — then and now. In 1907 it was limited to four ounces. Today two hundred pound castings can be produced, *and the end is not yet!*

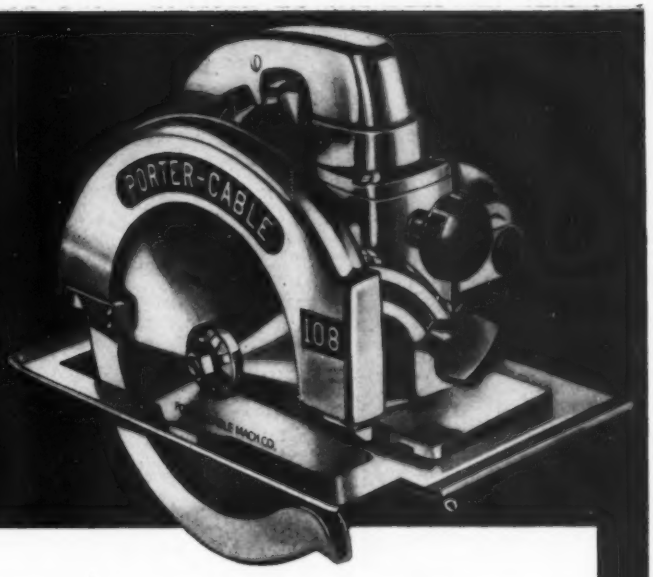
Since die casting is a process for the manufacture of metallic parts, two branches of technology, mechanical engineering and metallurgy, early joined hands and successfully turned die casting problems into die casting progress. Mechanical engineering has been responsible for the physical development of the process as related to the casting mechanism and the design and construction of dies, tools and other necessary equipment. Metallurgy developed suitable casting alloys and ferrous die materials. It has been responsible for the development of electroplating, painting and other finishing methods as well as the study of all factors concerned with the production of sound castings.

Any attempt to determine which one of these two branches of technology has contributed most to the phenomenal growth of the die casting industry would be irrelevant. Each has had to rely upon the other; neither could have proceeded alone. As a result of their joint efforts, one of the fastest and most practical low-cost production tools has been made available to the country's vast metal-working industries.



BUNKER HILL 99.99+% ZINC

DIE CASTINGS have Lighter Weight Greater Strength



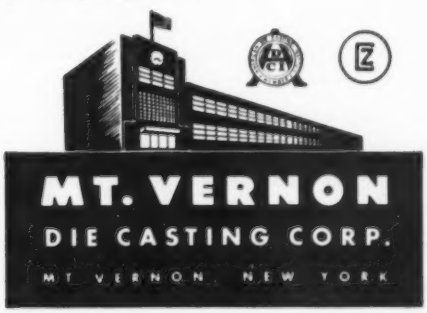
CASE HISTORIES FROM MT. VERNON FILES

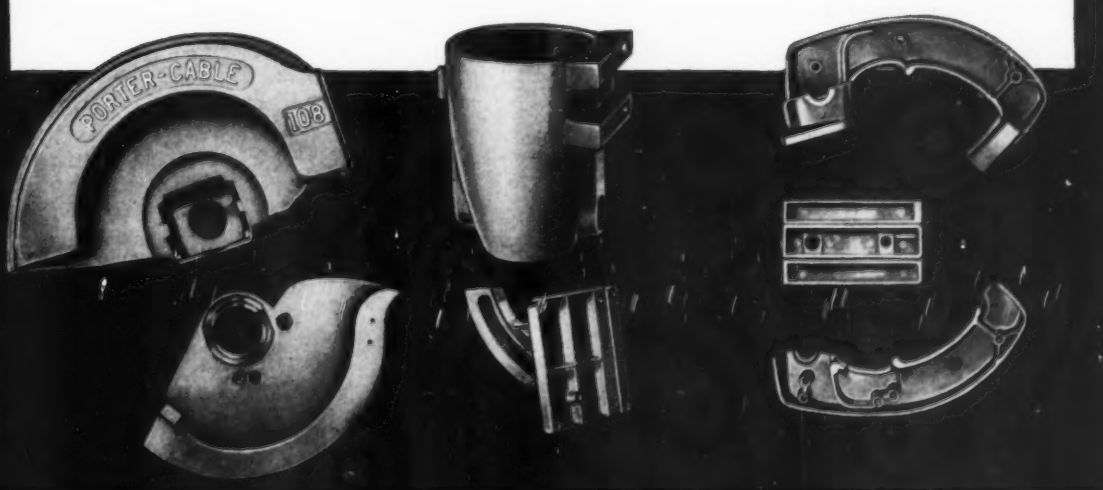
This Porter-Cable Model 108 portable electric power saw, designed especially to fit the needs of builders, maintenance men, and farmers, must be light in weight, strong, and have exact balance to permit convenient one-hand use.

That's why The Porter-Cable Machine Company uses aluminum die castings made by the Mount Vernon Die Casting Corporation. They're sold on the important advantages of their lighter weight, greater strength.

In fact, Porter-Cable uses Mount Vernon castings for many of their portable tools, because they find that die casting enables them to hold weight down to a minimum, lowers cost of tooling, provides high quality castings at reduced costs, speeds production schedules.

With Porter-Cable, Mount Vernon die castings prove themselves in action. Perhaps you, too, have products that require combined light weight and strength, or some of the other many advantages die casting can bring you. Let us go to work for you. Send us specifications or consult our engineering department.





For additional information Circle No. 21 on the Reader Service Card

brace yourself!

- - - it won't work!

Mountain dew may lubricate some things, but never die casting dies! Die Slick and Plunger-Slick are standard die casting die compounds, used by more than 80% of all die casters, with specific grades for aluminum, brass, magnesium, zinc or lead. They are non-staining, non-toxic formulae that aid parting, prevent galling or sticking, do not build carbon or gum deposits in dies. They promote good surface finish, are economical to use, and easy to apply. Plunger-Slick is the best available anti-seize compound for injection plungers of cold chamber machines, and is available in two grades.

Tell us what alloy you are casting and we'll send a trial gallon of the proper compound for production trial. No obligation, and the invoice will be cancelled if the compound does not solve your problem!

**Die casting machine for "miscellaneous work" patented in 1877 by C. and B. H. Dusenbury (Sectional drawing courtesy of MACHINERY.)*

start every job with **DIE SLICK**®

used by die casters everywhere

G. W. SMITH & SONS, INC., 5403 KEMP ROAD, DAYTON, OHIO

For additional information Circle No. 39 on the Reader Service Card

Between the Lines

in this and future issues of PMM

— HANDLING HARD METALS has been something of a problem. The design engineer would be likely to turn to these materials more often if he realized that there are at least two techniques by which the hard materials can be formed into "precision" components with minimum finishing or machining.

— TWO SOLUTIONS to this problem are pointed out in this issue of PMM. Powder metallurgy has not only been useful for producing finished shapes in hard materials such as the carbides, but it has actually been the only means by which some of these materials are practical . . . An article on this subject begins on page 34.

— CASTING HARD METALS is also practical, and in the more complex shapes, this is the only method. For example, investment casting is useful for shaping such super alloys as Tantung G which has properties of high hardness and corrosion resistance. How one company put this material to work via investment casting, is related beginning on page 37.

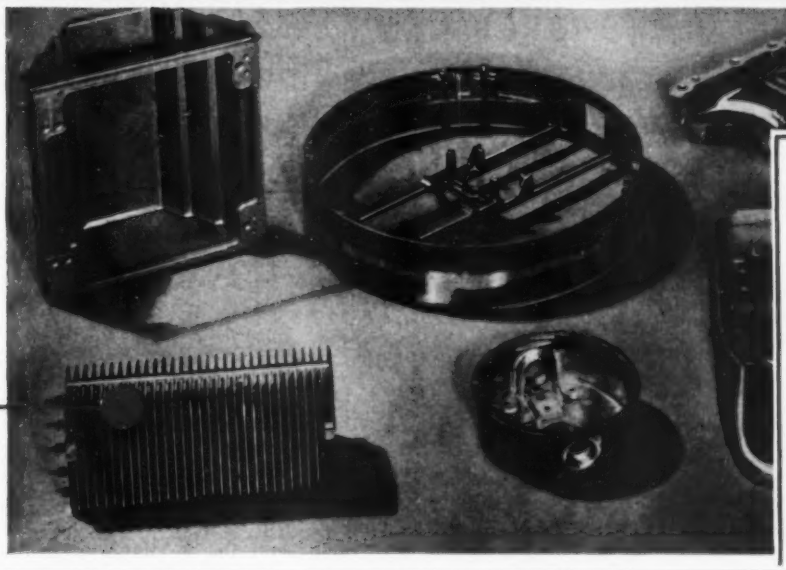
— HOW TO ADAPT a polishing wheel to be used with an abrasive belt and backstand setup is outlined in an informative article that begins on page 54 of this issue. Six exact steps to convert the buffing machine to a backstand belt machine are offered.

— FIRE HAZARD is one of the operating conditions that is always present when an oil

continued on page 16

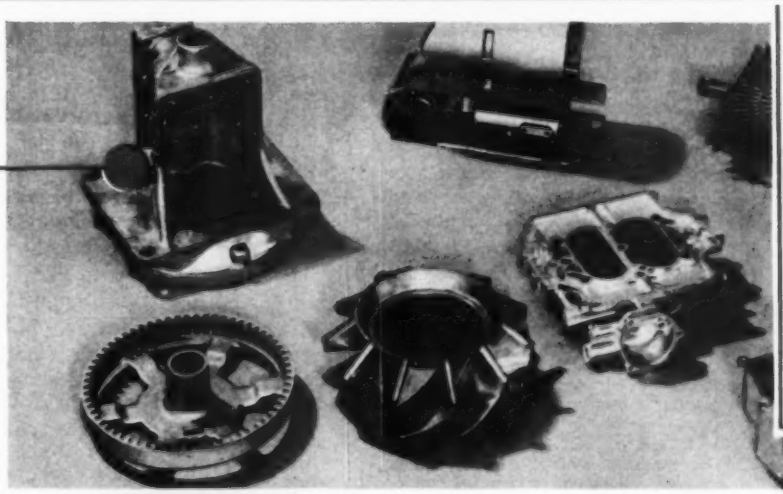
No Problem's Too Tough

when you call in ... PRECISION



THIN SECTIONS

Precision's ability to produce die castings with thin sections makes possible castings, where rapid heat transfer, weight reduction or lower metal consumption are desired.



FUNCTIONAL PARTS

Industry is increasingly turning to die cast functional parts. Today modern alloys plus Precision's design and engineering skills combine to produce rigid, strong, accurate functional die cast parts.

Since 1909 the name "PRECISION" has been the symbol of highest quality in the die casting industry.

PRECISION CASTINGS CO., Inc.

212 Walnut St., Fayetteville, N. Y.

Syracuse, N. Y. · Cleveland, O. · Chicago, Ill.
Kalamazoo, Mich. · Cortland, N. Y.

British Affiliation — Wolverhampton Die Casting Co. Wolverhampton, England

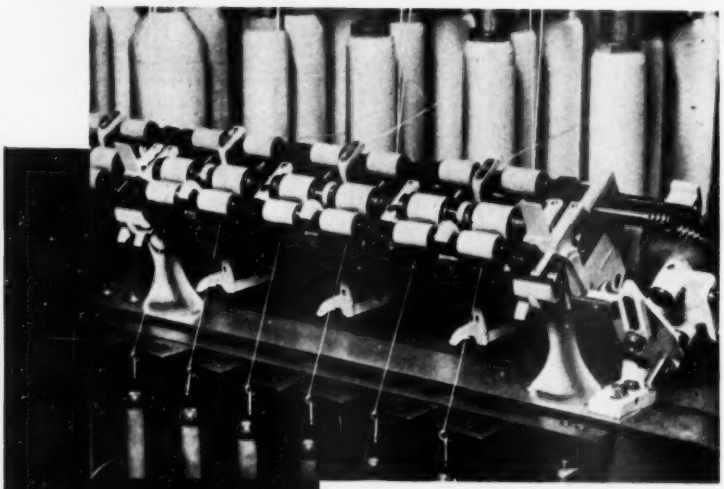
For additional information Circle No. 23 on the Reader Service Card

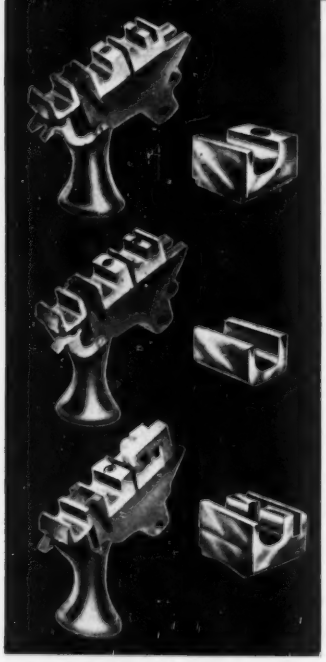
Proof of **WAKEFIELD** *Performance*

NO. 1 OF A SERIES

BECAUSE THEY WITHSTAND HEAVY TOP ROLL PRESSURE

SACO-LOWELL SHOPS USE *WAKEFIELD* ROLL STAND BEARINGS





Shaw Spinning, is one of the most effective long draft spinning assemblies in the world for cotton and short synthetics. After 10 years of experimentation, Saco-Lowell has found that fibre control required for long draft necessitated heavy roll pressure. This heavy pressure required a better, stronger, more rugged bearing. Saco-Lowell found that Wakefield bearings met and exceeded all their requirements.

For years, the Wakefield Bearing Corporation has produced all types of oilless and self lubricating bearings, bushings and machine parts. In addition, Wakefield holds an enviable reputation for quality and reliability in the production of all types of Special Textile Bearings and Parts including wood bearings, white wood turnings, swifts and swift parts and textile loom sheaves.

If you have a special problem our experienced research, development and engineering staffs are available for consultation without obligation. Our diversified and lengthy experience in the field makes Wakefield a name on which you can rely with utmost confidence to fill your requirements. Complete catalog information will be sent on request.

WAKEFIELD

BEARING CORP.

29-99 FOUNDRY STREET

WAKEFIELD, MASS.

In Canada: WAKEFIELD BEARINGS OF CANADA, Limited, 55 St. James St., West, Montreal, Can.

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BETWEEN THE LINES
continued from page 14

base hydraulic fluid is used near hot metal. The danger of a break in the hydraulic lines has been a normal condition in many die casting plants, and several disastrous fires have occurred as a result.

— SOLUTIONS to the fire problem have been sought, both by individuals and by industry-wide action. The Safety Committee of the American Die Casting Institute has given consideration to this hazard, as have individual die casters.

— BY USING non-flammable fluids, this hazard can be minimized or eliminated. The question is: what type of non-flammable hydraulic fluid should be used? Whenever a new non-flammable hydraulic fluid has been announced, the editors of PMM have tried to get information about its properties. In April 1952 (pg 46) was a report on one type of fluid. Recently, another manufacturer has announced a water-base hydraulic fluid claimed to be non-flammable. Again, PMM has asked the manufacturer to put together a report on some of the properties of the new fluid, together with data on installation, maintenance, cost, etc. This report is offered on page 88 of this issue.

— ENGINEERS sometimes have to practice psychology, especially, when their products have to be used by the general public. One of the men responsible for designing those parcel lockers that occur in almost every train, bus and airline station tells an interesting story on engineering versus human carelessness beginning on page 32.

DOLLIN ZINC and ALUMINUM DIE-CASTINGS

Specified by many leading manufacturers

for high quality at low cost

Dollin's specialized equipment cuts costs through all commercial sizes. For example, *high speed* production of small zinc castings (1000 per lb. to 3 per lb.) is available on *fully-automatic* machines in our *Small Castings Department*. Small Parts Bulletin and samples, General Bulletin available on request.

SALES OFFICES: Boston • Buffalo
Canton • Chicago • Detroit
Philadelphia • Pittsburgh • St. Louis
St. Paul

Send prints or samples for estimates and engineering advice, at no obligation

DOLLIN CORPORATION
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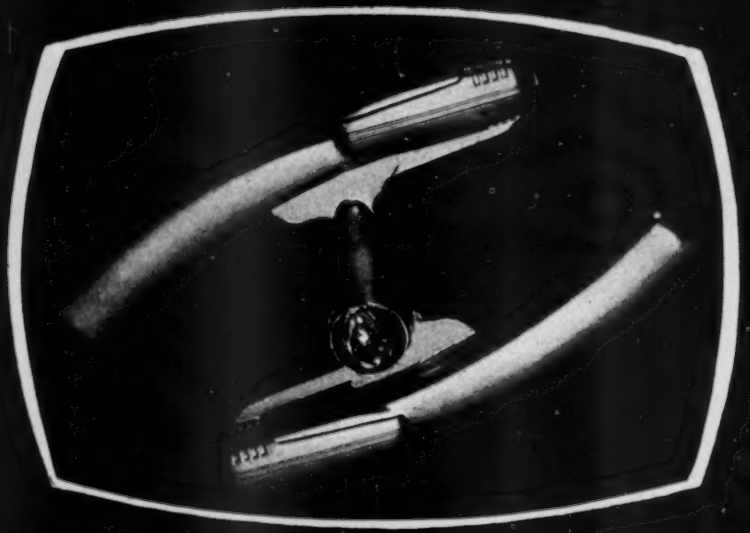
telling the story of 'dag' dispersions



Compare Your Present Die Lubricant With 'dag' Colloidal Graphite

Your Present Die Lubricant	'dag' Colloidal Graphite
1. Is it difficult to apply?	1. Easily and quickly sprayed on, painted on, or applied by dipping.
2. Does it break down at high temperatures?	2. Totally unaffected by heat up to 750°F. Forms tenacious *dry lubricating film* on die surfaces.
3. Does it fail to prevent *all* die sticking?	3. *Prevents all sticking in the die.*
4. Does it present production problems?	4. Improves product finish, reduces carbon build-up in die impressions. Can also lubricate ejector pins and plungers... prevents sticking and jamming.

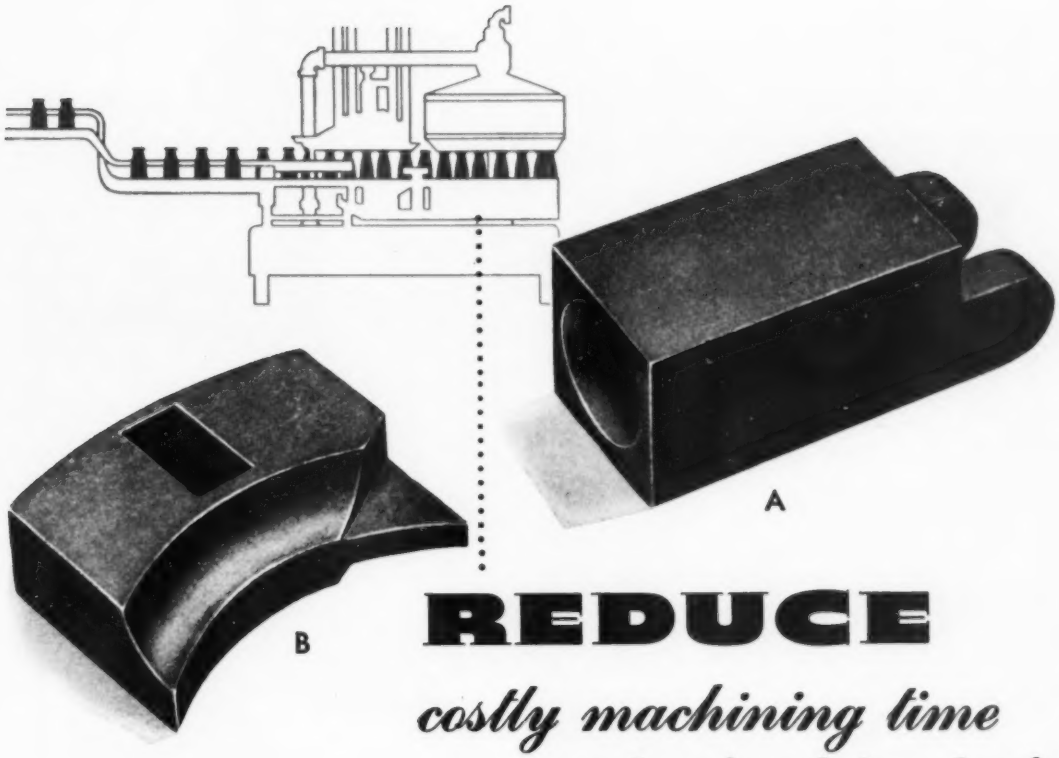
More advantages of 'dag' colloidal graphite dispersions are explained in Reprint DC and Bulletin No. 426-30L.

Dispersions of molybdenum disulfide are available in various carriers. We are also equipped to do custom dispersing of solids in a wide variety of vehicles.

dag DISPERSIONS

Acheson Colloids Company, Port Huron, Mich.
... also ACHESON COLLOIDS LIMITED, LONDON, ENGLAND
Units of Acheson Industries, Inc.

try 'dag' resin bonded dry films for permanent lubrication



REDUCE

costly machining time and extend product life

with Crucible ACCUMET Precision Investment Castings

Where parts are intricate or machining difficult, substantial savings can be made by using Crucible Accumet Precision Investment Castings.

The Type 303 Stainless castings shown above (A & B), for example, eliminated practically all expensive machining operations for a manufacturer of milk bottling machinery.

In many cases life of component parts can be greatly extended by using castings of high-alloy grades impractical to machine. The ring illustrated (casting C), used in a fine wire feed mill, is an investment casting made of Crucible *Rexalloy*, a non-ferrous cobalt-chromium-tungsten alloy steel providing exceptional wear and abrasion resistance.

Crucible engineers and metallurgists are available to help you solve design problems or lower production costs with Accumet Precision Investment Castings. Write now for further information.

CRUCIBLE first name in special purpose steels

53 *years of* Fine *steelmaking*

ACCUMET PRECISION CASTINGS

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MAX-EL MACHINERY • SPECIAL PURPOSE STEELS

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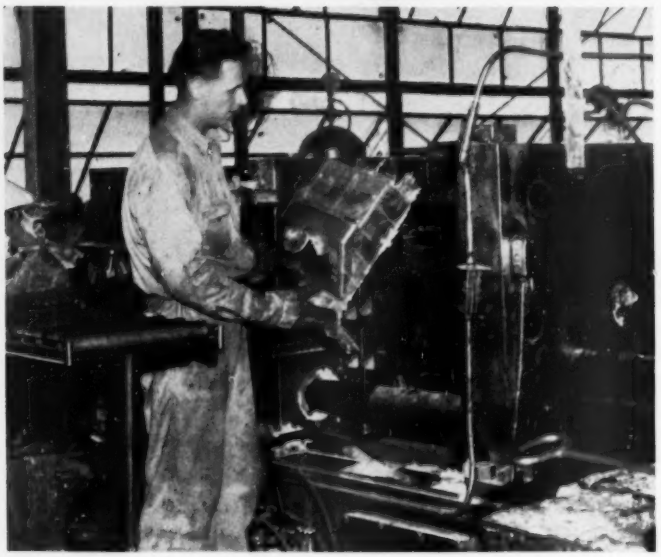
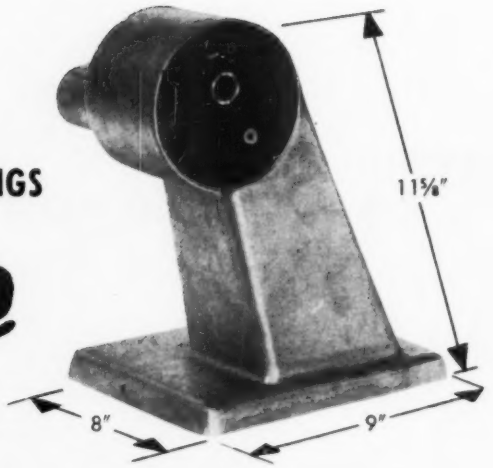
PEMCO

PRODUCES ALUMINUM DIE CASTINGS

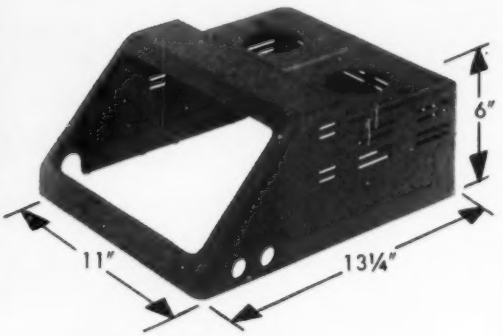
king size





8¼ LB. SHOT

Roll drive housing for electric ironer. Produced for Bendix Home Appliance Co., South Bend, Ind. Finished casting weight is 6.9 lbs.



4¼ LB. SHOT

Tape recorder housing cast for Permoflux Corp., Chicago, Ill. Photo at left shows operator removing the as-cast housing from the Cleveland Model 400 Die Casting Machine. Finished casting weight is 3 lbs.

WITH CLEVELAND MODEL 400 DIE CASTING MACHINES

The two castings shown above are typical of the top quality output of Product Engineering and Manufacturing Corp., Bridgman, Michigan. And like many other leading die casters, the mainstay of PEMCO's casting production are Cleveland Model 400 Die Casting Machines.

With the Cleveland Model 400's tremendous die locking pressure, high-speed shot injection, and rapid die closing and opening action, PEMCO receives a continuous flow of dense, hardware finish castings at a highly profitable rate of production.

Let Cleveland's time-proved leadership in die casting machine design give your die casting department or shop the same dependable performance—on zinc and aluminum castings—large and small—simple and complex. Ask a Cleveland sales engineer to show you the many Cleveland Model 400 advantages. For information on machine design details and specifications, write for Bulletin 400.

Remember: *Clevelands Cut Costs*

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4952 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
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Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

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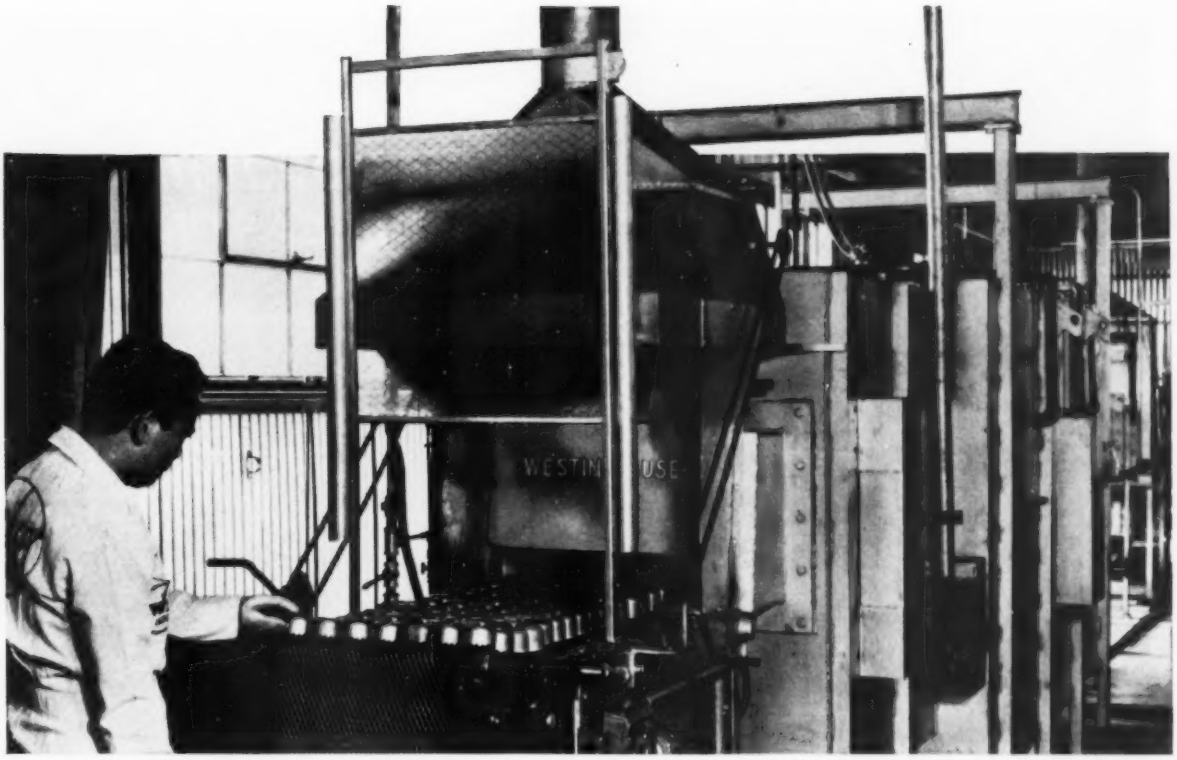

"Production capacity increased 400% with Westinghouse Sintering Furnace"

. . . says Kwikset Locks, Inc.

As the largest producer of custom-molded powdered metal parts west of the Mississippi, Kwikset Locks, Inc., of Anaheim, California, has this to say about its Westinghouse Sintering Furnace:

"We chose a Westinghouse Electric Belt Conveyor Furnace when desiring four times the production capacity formerly available. We now enjoy the desired protective atmosphere needed for top-quality control, gain excellent temperature control and response, and take advantage of fast Westinghouse engineering and repair service. We have found, through experience, that Westinghouse Furnaces are easy to operate.

"Our principal operation is sintering brass components for our residential and commercial lock sets. These parts were formerly machined from bar stock, precision cast or stamped. By converting to the sintering process with a Westinghouse Electric Belt Conveyor Furnace, we have eliminated scrap and machine finishing . . . thus increasing production and reducing costs."

Why not investigate Westinghouse Heat-Treating Furnaces for your plant? A complete line covering every heat-treating job is available. Write for free book *Harnessing Heat* (B-5459). Westinghouse Electric Corporation, Industrial Heating Department, Meadville, Pennsylvania. J-10411

IF YOUR PRODUCT CALLS FOR HEAT-TREATING . . . IT CALLS FOR A WESTINGHOUSE FURNACE . . . GAS OR ELECTRIC.

YOU CAN BE SURE . . . IF IT'S

Westinghouse

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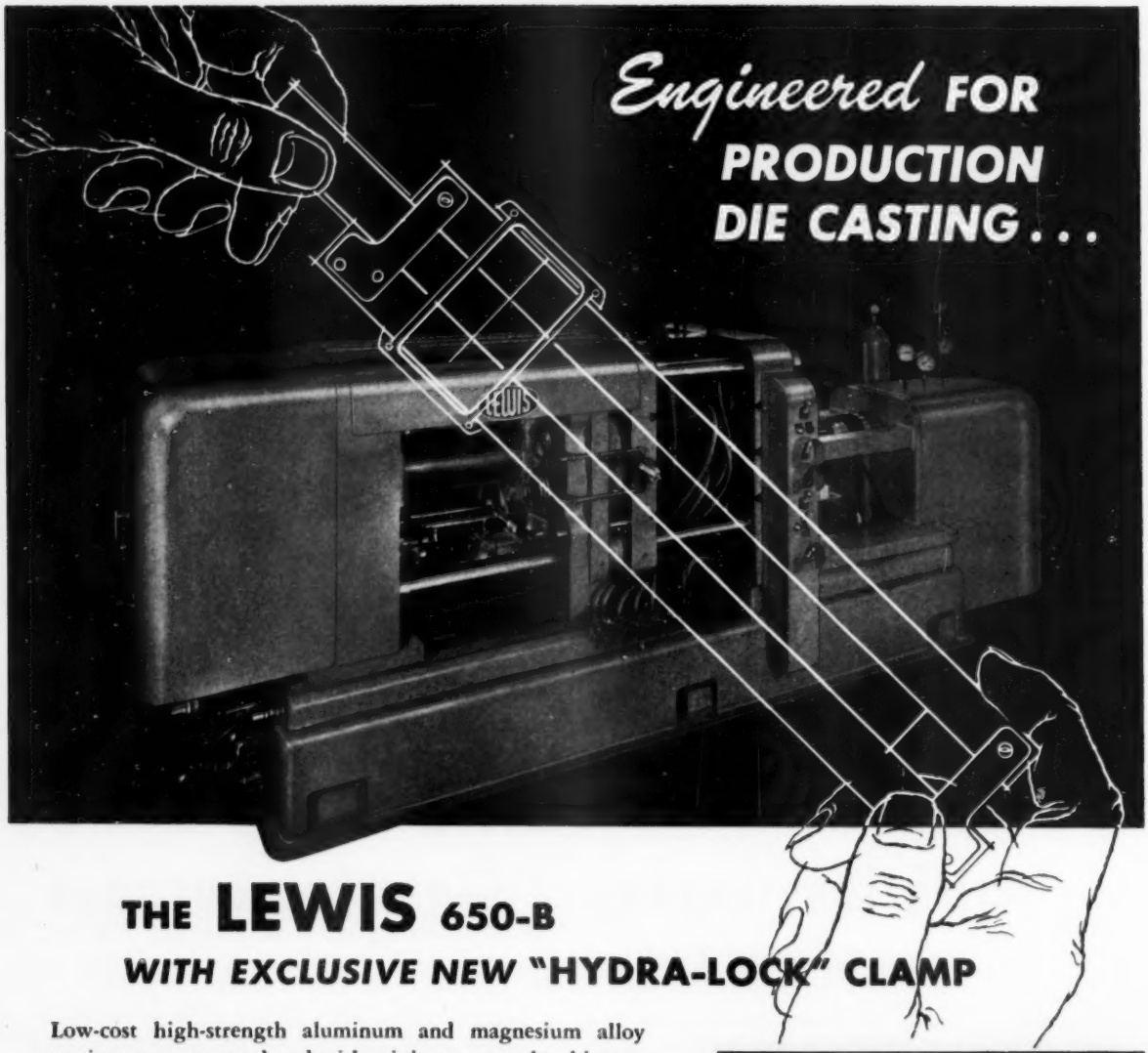


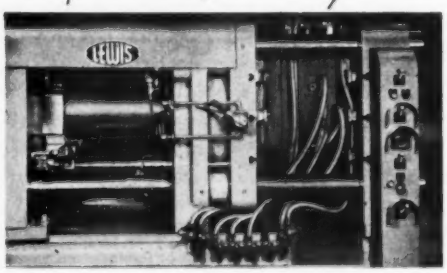
THE LEWIS 650-B

WITH EXCLUSIVE NEW "HYDRA-LOCK" CLAMP

Low-cost high-strength aluminum and magnesium alloy castings are mass produced with minimum scrap by this new LEWIS machine. Featuring rapid 2-stage injection with pressures up to 100,000 pounds . . . a 650-ton hydraulic clamp . . . large platens . . . faster, easier die setting . . . finger-tip controls . . . and a remote power source for flexibility of installation, the Model 650-B brings new concepts of economy, safety, speed and quality to the die casting industry.

The powerful "HYDRA-LOCK" clamp assures maximum safety. Its design also provides a ball-and-socket action that compensates for misalignment of die faces within reasonable limits.

For profitable production of accurate, flawless, high tensile castings . . . specify the LEWIS 650-B! It has no equal for economy . . . safety . . . quality.



"HYDRA-LOCK" clamp in closed position. A sliding block automatically moves into position behind strut to assure full locking pressures for clamping mechanism.

WRITE FOR BULLETIN 103 FOR DETAILS AND SPECIFICATIONS.

LEWIS

LEWIS WELDING & ENGINEERING CORP.

63 INTERSTATE STREET • BEDFORD, OHIO

DISTRIBUTORS

KORDENBROCK MACHINERY CO.
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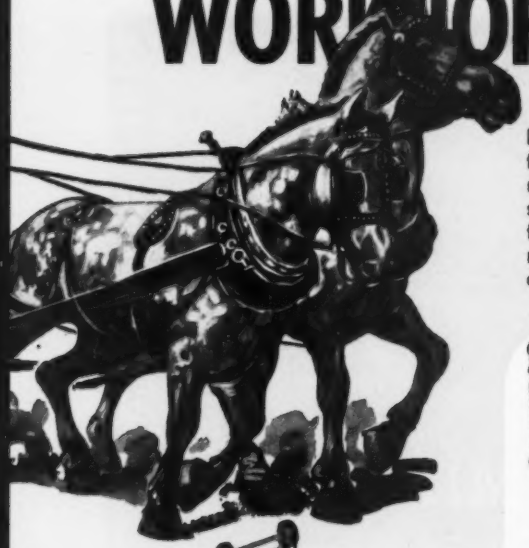
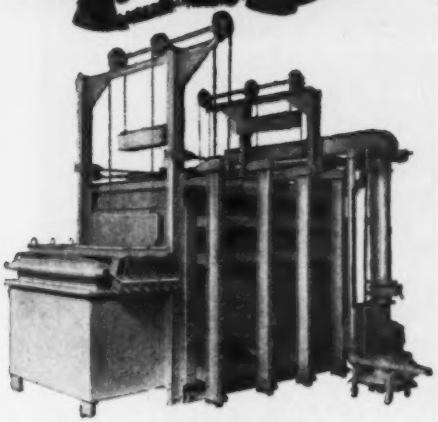
WORKHORSES for ALUMINUM

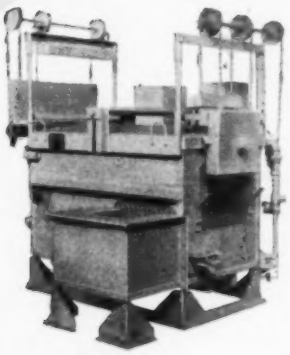


Here are the furnaces that bear the brunt of the burden in the aluminum foundry industry. They are designed for production of unsurpassed quality metal, in the fastest, most efficient and economical manner. Each has its specific purpose and capacity, meeting the exacting demands of sand foundries, die casters, permanent mold plants and smelters. They are recognized as the finest in the industry, reduce costs and make working conditions most agreeable. All furnaces may be fired by either gas or oil.



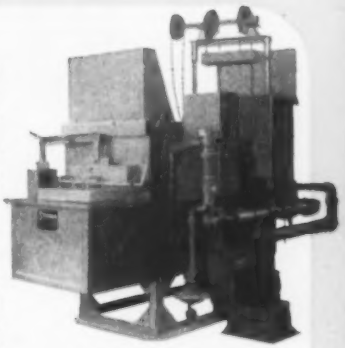
SMELTERS FURNACE

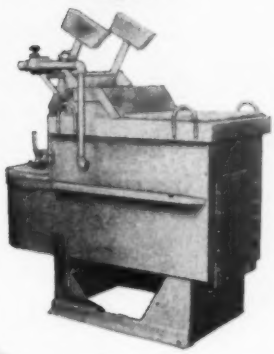
Built especially for smelters and other large melters. Easy charging, drossing, fluxing and alloying. Can be built to your own specifications. Capacities from 3000 lbs. Aluminum up.



MODEL "DC" FURNACE

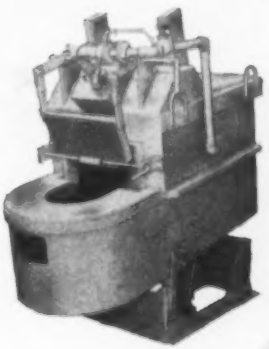
The 2 in 1 furnace. Breakdown and Holding in the same unit. Cold metal never reaches the molten bath. Assures metal of the finest quality on all classes of work. Close temperature control. Can be used as a sweat furnace for reclaiming inserts. Ideal for all types of plants including sand, permanent mold and die casting. Capacities from 350 lbs. Aluminum up.

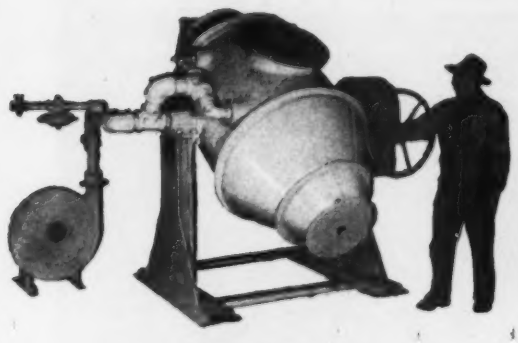




MODEL "DSC" DIE CASTING FURNACE

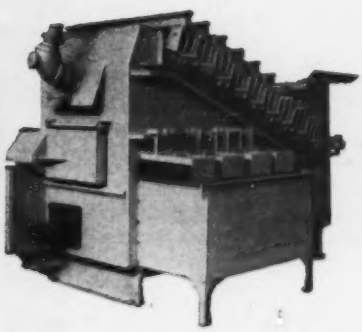
A small reverberatory furnace for melting and holding, or for holding only when hot charged at the die casting machine. Made in various sizes to meet your requirements.





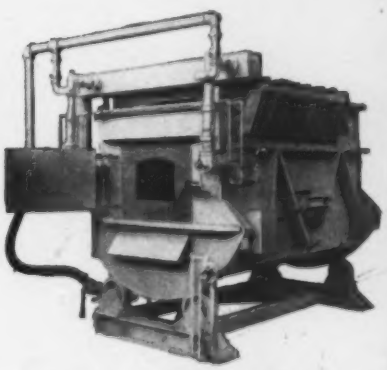
MODEL "BFC"

Hand tilt, open flame, barrel type furnace with flames firing tangent to inside of lining. Very fast melting. Used in all type plants including smelters. Capacities—500 lbs. Aluminum. A must for all aluminum jobbing sand foundries.



MODEL "MC" DIP-OUT TYPE

For melting and holding all in the same furnace. Hot metal always available. No iron pots or crucibles to replace. Capacities from 500 to 5000 pounds of aluminum.



MODEL "SW"—TILTING TYPE

Excellent to run back returns along with ingot required for permanent mold, die or sand casting operations. Also an ideal breakdown furnace. Capacities—600-1000-1700-3000 lbs. Aluminum.

STROMAN FURNACE & ENGINEERING CO.

DIVISION OF

THE PETERSEN OVEN CO. • 9900 FRANKLIN AVE. • FRANKLIN PARK, ILL.

NOW

USCO

a great name in ALUMINUM . . . becomes a new name in ZINC!

For as long as there has been a die casting industry, the U. S. Reduction Co. has been a supplier of quality aluminum die casting alloys. Now, with the production of zinc die casting alloys, we can offer a complete service to the die casting industry.

Both USCO No. 3 and USCO No. 5 Zinc Die Casting Alloys are produced under rigid USCO quality standards to ASTM specifications using only 99.99% slab zinc and our own special al-mg or al-mg-cu hardener. We appreciate having been a part of the tremendous growth of the die casting industry. We now are prepared to supply your requirements of both great metals, ALUMINUM and ZINC.

For 49 years, pioneers in aluminum development.

USCO U. S. REDUCTION CO.
East Chicago, Indiana

PLANTS: EAST CHICAGO, INDIANA • TOLEDO, OHIO

Designing FOR MULTIPLE PRODUCTS

IN SINGLE TOOLING WITH MADISON-KIPP

ZINC AND ALUMINUM DIE CASTINGS

The three castings illustrated are made in the same die. Provision for the changeable die parts must be included in the original die design. Expert die making is also involved, but the end results of this type of pre-planning represent substantial savings in many instances.

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GIANT DIE CASTINGS

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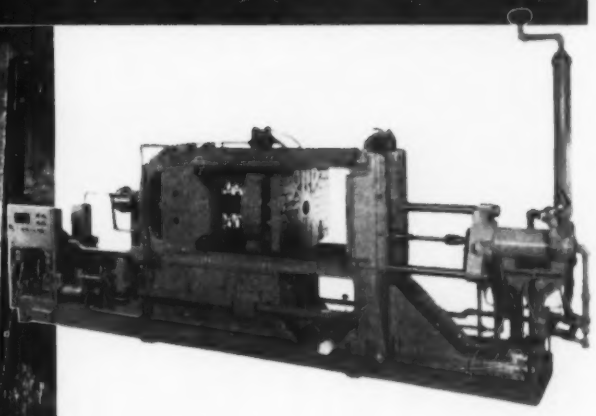

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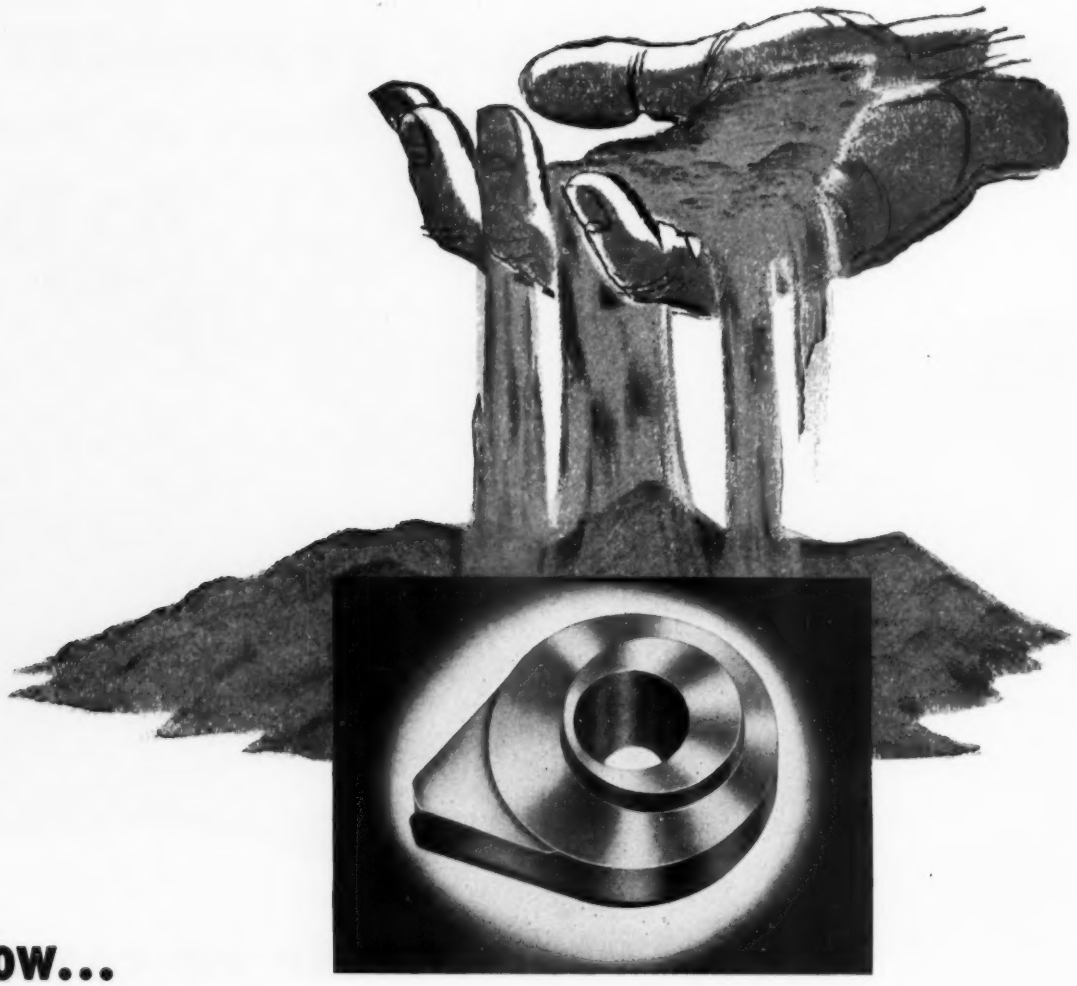

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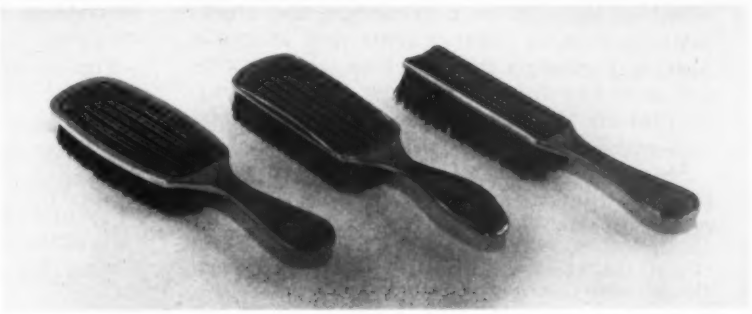
Sand castings have lost out to die castings for these brush backs . . .



THE SHORTEST ROUTE from gate to polished casting . . .

By HARRY SMITH*

TAKE a die casting, a piece of nickel silver wire and the bristles of a wild Asiatic boar and what do you have — a hair brush of course. The boar bristles are standard but essential for good grooming of hair. The nickel silver wire is standard, to hold the bristles in place will not corrode. But the die casting has its own story; an old story if you will, but as consistent as anything can be in this inconsistent world.

Over the years the trend toward conversion of sand castings to die castings has been apparent and, as the price of die castable alloys steadily decreases, more and more manufacturers are turning to die casting as a means of lowering their manufacturing costs. Where formerly only those products that were made in large numbers of duplicate parts could be economically die cast, today the high cost of all operations has lowered the dividing line to where only a relatively few thousand pieces per year can be converted at a substantial cost reduction.

The die cast back used on hair brushes made by the Hygenia Brush Co. can well be taken as an example of the change from a machined sand casting to a die casting in the field where the number of duplicate parts, while not small, is not of the tremendous numbers one often associates with a die cast product.

The brush backs shown here are three of the many different styles currently in use, any one of which illustrates the conversion.

Originally these were sand cast in aluminum. The casting as delivered from the foundry consisted of a group of backs mounted on a single gate and runner. The outline of the back was well defined, but around each casting was a

continued on page 80

*President, Hygenia Brush Co., Worcester, Mass.

These designers

By HENRY BEIMEL*

PROBLEM: MILLIONS of people each year check parcels in the coin-operated lockers provided in bus and train terminals and other public places. It takes a great deal of engineering to design these lockers, not only to foil would-be thieves, but just as important, to protect Mr. Parcel Checker against his own carelessness.

Many thousands of these lockers have been built, installed and serviced by the American Locker Co., Inc. We have found, in more than 35 years of experience, that it isn't enough just to provide burglar-proof storage . . . it calls for a bit of applied psychology to outguess people at their own mistakes.

For instance, our lockers have to be designed so that it is impossible to . . .

. . . insert a coin and turn the key without first closing the locker door,

. . . insert a coin in a locker that is already occupied, thereby losing the coin,

. . . place a parcel in a locker and then

*Chief Engineer, American Locker Co., Inc. (shown above, second from left).

SOLUTION: There are two principal phases of designing a safe parcel locker: 1) provision of mechanical features that will guarantee performance only in a carefully predetermined manner; 2) selection of materials that are equal to the maximum force that may be applied.

While it wouldn't be feasible to go into detail about the mechanical safety features, a single example will illustrate this phase of our designing.

The latch is an irregularly-contoured piece incorporating slots, holes, projecting lugs, cams and other shapes, each designed to actuate a part of the mechanism in correct sequence.

It has a hole for the latch pin which remains engaged until the locked door is closed, thus preventing the key from being turned while the door is open.

It has a cam which guides a cover across the coin slot as the key is turned, thus preventing any more coins from being inserted while the compartment is locked.

It has a slot in which a small pin rides, permitting an escapement to drop into locking position when the key is removed, and lifting the escapement out of engagement

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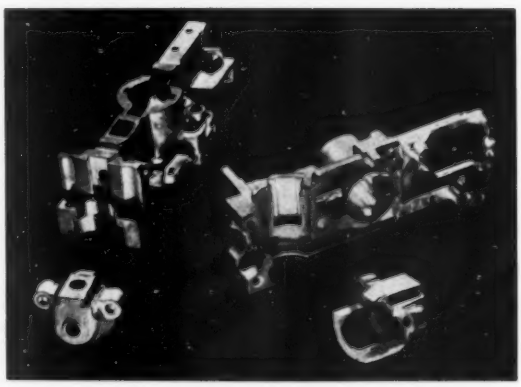
Die Castings



CHASSIS on which the entire lock mechanism is mounted is this extremely complex zinc die casting, shown here together with the lock castings. Notice the dovetail slots cored into the lock housing, and the dovetail formed on the bottom of the lock. These two pieces fit together into an assembly after the dovetail on the lock is shaved.

Provision for mounting and housing multiple interrelated components has been provided by this complex die casting. Although detail changes have been made during recent years, substantially the same casting has been in use for several decades. It is die cast by the Doehler-Jarvis Div., National Lead Co.

found a way to build - - -
A FOOL-PROOF STORAGE LOCKER

lock the door of a different locker without first glancing inside,

. . . remove the key without first turning it to lock the door,

. . . open the wrong locker by mistake,

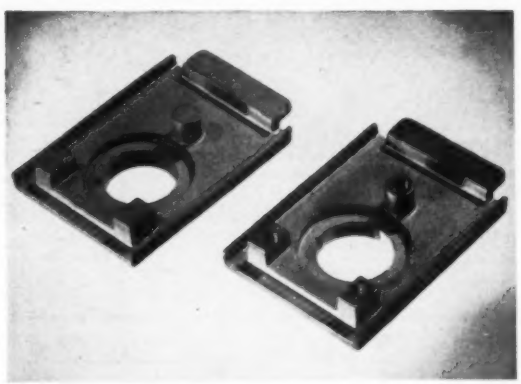
. . . and many more, too numerous to list.

Besides these considerations, there are other functional requirements of the locking mechanism, coin storage box and front plate.

The lockers are leased, not sold, so that the entire responsibility for service and maintenance is assumed by this company. Lock units have to be quickly and easily removable by the serviceman, and all units must be interchangable, regardless of the age or style of locker. With thousands of lockers currently in use, this is an important problem.

Or look at the task of preventing vandalism . . . all exterior components must be able to withstand jimmying, skeleton keys and other attacks short of dynamite. Even the coin storage box has to have a front plate tough enough to keep out hoodlums.

Plaster Mold Castings



THIS manganese bronze plaster mold casting covers the coin drawer. The alloy was chosen because of its high tensile strength, between 155,000 - 175,000 psi, which is sufficient to resist any tampering.

Long life of the patterns for this casting has meant that a completely uniform, smooth-surfaced piece is supplied year after year. Only secondary operations required after the castings are received are drilling and tapping the three holes to mount the lock unit, and ream and counterbore the center hole. The castings are painted to match the finish of the cabinet. They are being produced by Atlantic Casting & Engineering Co.

Investment Castings

ONE of the most critical components in the entire locking mechanism is this latch cast in beryllium copper. Notice the number of special contour variations and the several thicknesses. Size, dimension and flatness are critical because several stages in the locking operation are actuated by this piece.

Seven machining operations such as drilling and countersinking are done on the casting which is solution annealed and heat treated. Substantial machining and assembling would be required if this were fabricated from sheet and bar stock, and accuracy and strength would suffer. It is cast in beryllium copper by Hitchiner Manufacturing Co., Inc.

1. THIS resistance type hot press molds and heats powdered metals at temperatures of 2600F under pressure to produce large tungsten carbide sections.

TAILOR-MADE METALS . . . and their properties

By K. R. BEARDSLEE*

WITHIN certain limits, the metalworking industry has been able to meet its needs for engineering materials by refining ores, alloying metals in the liquid state and by developing heat treatment processes. There is, however, a range of physical properties which are not attainable by liquid alloying or subsequent heat treating.

Thus it was natural for engineers to develop a technique whereby combinations of metals, or metals and nonmetals, can be intimately mixed and processed to create materials having properties not possible by conventional methods.

Furthermore, this new method makes possible a uniformity in metallurgical structure difficult to achieve otherwise.

In this process, pure powdered metals can be weighed, mixed, compacted and sintered to produce a material with properties different from those of any of the original ingredients. Because this powder metallurgy process is a flexible one where ingredients and processing can be accurately altered and controlled at will, it is possible to create new families of metals, each of which provides unusual

*General Manager, Carboloy Dept. General Electric Co.

properties that can be of great value for specialized applications.

In the cutting tool field, much effort was devoted to producing metals that were sufficiently hard and abrasion resistant for cutting tools in machining operations. Carbon steels, tool steels and high speed steels were developed over a period of years to obtain better cutting tool life and permit increased machining speeds.

A specialized metal, created by the powder metallurgy process — cemented tungsten carbide — was the next step in the development of a cutting tool material. A chart of properties of cemented carbides produced by Carboloy is presented in Table 1.

It is the hardest metal made by man and stays hard at high temperature. This red hardness feature permits extremely high machining speeds. Some grades of carbide are harder at red heat than high speed steel is at room temperature.

Since the metal can be brazed, clamped or bonded to other metals, it is extremely flexible for use in cutting tools. Flexibility of the powder process also led to the development of various special grades for a multitude of specialized cutting tool applications.

Because tungsten carbide provides extreme hardness and abrasion resistance, it became an important engineering material for wear proofing on mechanical applications.

To meet wear resistant requirements, various methods for fabricating tungsten carbide were developed. Rings, for example, now can be made by bending rectangular tungsten carbide bars. A wear resistant surface can be welded to steel in many places by using tungsten carbide welding rod. The ability of tungsten carbide to withstand high loads and speeds with close running fits also furthered the application of this material to specialized modern machinery applications.

Because of the increased needs by both military and peacetime equipment designers for a material superior in some qualities to tungsten carbide for specialized applications, through the powder metallurgy process, we developed chrome-carbide. This material has unusual corrosion and oxidation resistance.

The process for producing this specialized metal is similar to that for producing tungsten carbide from powders. Briefly, it is produced as follows:

1. Definite quantities of chromium oxide powder and carbon powder are measured by weight in proportion of 75 parts of chromium oxide to 25 parts of carbon. (In producing tungsten carbide, pow-

continued next page

TABLE I

NOMINAL PROPERTIES OF CEMENTED CARBIDES

Grade Designation	Composition % by Weight				Hardness Rockwell A 60 Kgm Load	Density gms/cm^3	Transverse Rupture Strength psi	Young's Modulus psi	Ultimate Limit in Compression psi	Relative Abrasive Resistance Dry Al Oxide	Torsional Modulus psi
	WC	Co	TaC	TiC			x10^3	x10^6	x10^3		x10^6
999	97	3			92.6	15.25	175	97.5	815	6.6	
883	94	6			92.0	14.95	215	88.0	790	6.5	36.5
44A	94	6			91.0	14.95	230	84.5	700	8.0	36.0
779	91	9			89.2	14.65	300	83.0	685	12.3	34.0
55A	87	13			88.2	14.20	330	79.0	610	13.0	32.5
55B	84	16			86.0	13.82	365				
190	80	20			85.0	13.52	350				
78	76	8	4	12	92.0	11.80	195	90.0	720		
78B	82	10		8	90.5	12.55	215			11.2	
905	93	3	3.85	.15	92.1	15.10	200			7 6	

dered tungsten is used in place of chromium oxide powder, and the mix ratio is different.)

2. The powders are mixed.

3. The mixture is placed in graphite containers and heated to form chrome carbide particles.

4. Measuring and mixing definite quantities by weight of chromium carbide particles and nickel powder — the binder. (In producing tungsten carbide, cobalt is used as a binder.)

5. This mix is ball milled to blend the carbide particles with the binder, and reduce particle size.

6. The milled mixture is then molded on mechanical presses to form blanks.

7. The blanks are sintered.

The resulting chromium carbide metal is an engineering material with unusual physical properties. It has good resistance to abrasion and extremely high resistance to corrosion. It has a coefficient of thermal expansion as follows:

68 to 248F, 4.9×10^{-6} in./in./degree F.
68 to 427F, 5.1×10^{-6} in./in./degree F.
68 to 680F, 5.3×10^{-6} in./in./degree F.
200 to 1800F, 6.1×10^{-6} in./in./degree F.

Weight of chrome carbide is about half that of tungsten carbide. It also is nonmagnetic. High temperature tests at 1850F for 24 hours show chrome carbide to discolor only slightly while simultaneously exposed samples of stainless steels and tungsten carbides had partially or completely disintegrated.

The first permanent magnet material used by electrical designers was carbon steel. Later better chromium steel and cobalt alloys were developed.

Further needs for powerful, compact permanent magnets were met in the middle thirties when specialized metals now known as Alnico were devloped. Various types of Alnico magnets can be created either by a casting process where a controlled liquid mix of aluminum, nickel, cobalt iron and copper is poured into a sand or investment mold, or by the powder metallurgy process where powders of the same ingredients are mixed, compacted and sintered.

The creation of the Carboloy Alnico permanent magnets is a typical example of a man-created metal that changed the designs of meters, instruments, radios, generators, magnetos and many other pieces of industrial equipment.

Another metal ceramic material recently developed for high temperature applications is titanium carbide.

It is also possible to create extremely dense metals by the powder metallurgy process. Such a development is Hevimet which is a tungsten alloy. This unusual material is 50 percent heavier than lead and

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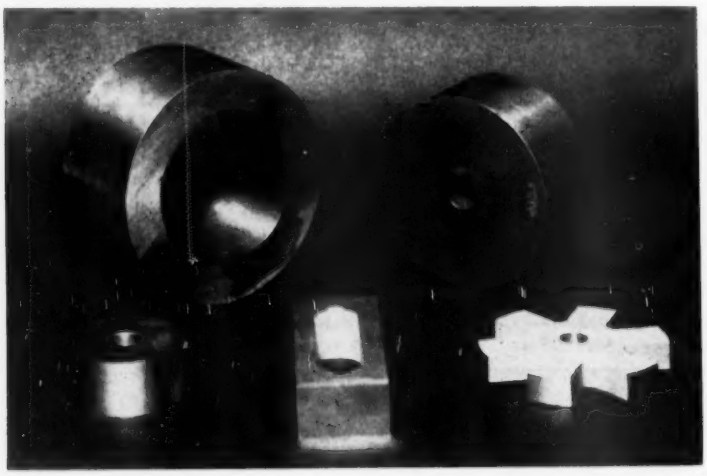
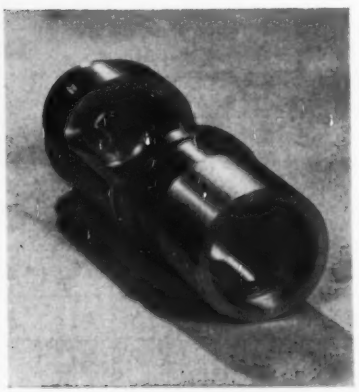
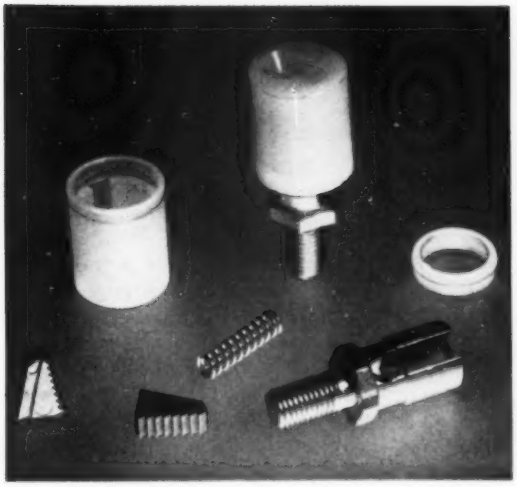
Two special products of powder metallurgy:



High Density Metal →

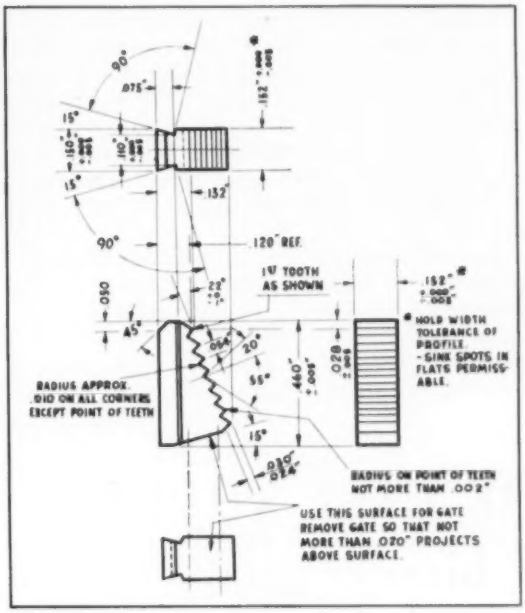
Permanent Magnets ←





1. TOOTHED locking cam is spring-loaded against an inclined plane in the central stud to hold Signal Corps communication wire. By depressing the nylon cap, the cam is disengaged and the wire released.

2. SHARP DEFINITION of the cam teeth is a critical requirement, gained here by investment casting them in Tantung G, which is virtually corrosion resistant at ambient temperatures and has high hardness.



SUPER-ALLOY meets Signal Corps requirements

By WALTER F. SCHUCHARD*

WHAT started out as a cost reduction study in connection with a piece of Signal Corps field equipment manufactured by S. H. Couch Co., Inc., has resulted not only in the original objective but also in the introduction of improved materials.

While investigating ways to save machining on several steel components, it was found that superior corrosion resistance could be obtained at lower cost by substituting an investment casting in a Super Alloy, along with a pair of molded nylon pieces.

The equipment is portable wiring board for making rapid communications connections in the field. Major cost element in building these units was found to be the 48 spring binding posts, shown above assembled and disassembled.

The spring binding post holds the communications wire by means of a spring-loaded locking cam which presses against an inclined plane on the central stud. By depressing the nylon cap which covers the assembly, the locking cam is released and the wire can be slipped in or out to make or break the connection.

The prototype model of these spring binding posts had the cap and the toothed cam machined from steel stock. Not only did this seem to us to be too expensive a method, but it was believed that the very severe corrosion resistance specifications could not be met by the ferrous alloys, even when plated.

Signal Corps requirements on the cam, for example, call for hardness of Rockwell 50 C,

continued next page

*Chief Engineer, S. H. Couch Co., Inc., Boston Mass.

and corrosion resistance to withstand 100 hours salt spray testing. At the end of that period of exposure, the gripping teeth on the cam must have sharp enough definition to hold the wire firmly.

This combination of requirements can be satisfied by the so-called super alloys, and the small size, close dimensions and irregular shape suggested the use of investment casting. Fortunately, we were able to find a source of supply and an investment caster experienced in working with this material. Vascaloy-Ramet Corp. were able to cast these cams in their Tantung G, which has a composition of tantalum, tungsten, chromium and cobalt.

Tolerances called for on the cams are quite close. but still within commercial practices, as can be seen from the detail drawing, Figure 2.

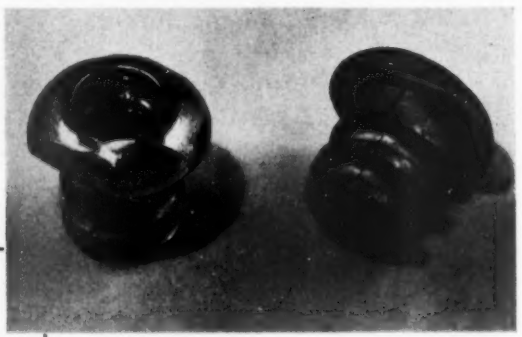
Several variations in the design of these cams have been tried differing mainly in the method of assembling them inside the cap. This design, which has proved to be very practical in production, calls for a dovetail mounting surface which fits into a dovetail slot formed in the nylon cap. The cam is slipped into the groove, and a nylon retaining ring is snapped into place in an annular groove. This is quick, dependable, durable.

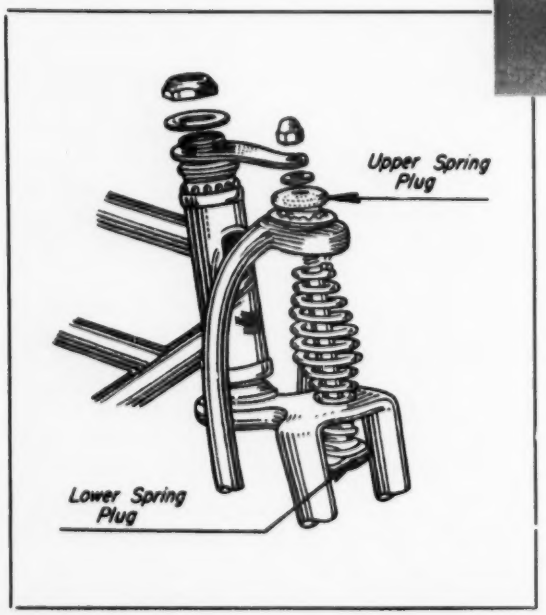
In designing the cap, two designs were put through the sample stage, one nylon and one produced from powdered iron. Due to the inherent porosity of the latter, however, extra impregnation or corrosion protection was required, and decision was made in favor of the molded nylon piece.

The nylon permitted use of a molded retaining ring, as can be seen in Figure 1. When annealed, the material can be snapped into position quite readily.

Investigation of new materials, and new fabricating methods paid off here in improved performance at lower cost. We have also found that investment casting, as an experimental method, has much to offer. New designs being studied and put through pilot runs can be investment cast with moderate tool costs. This saves the delay in making hand models and permits working out final details before spending money for production tools.

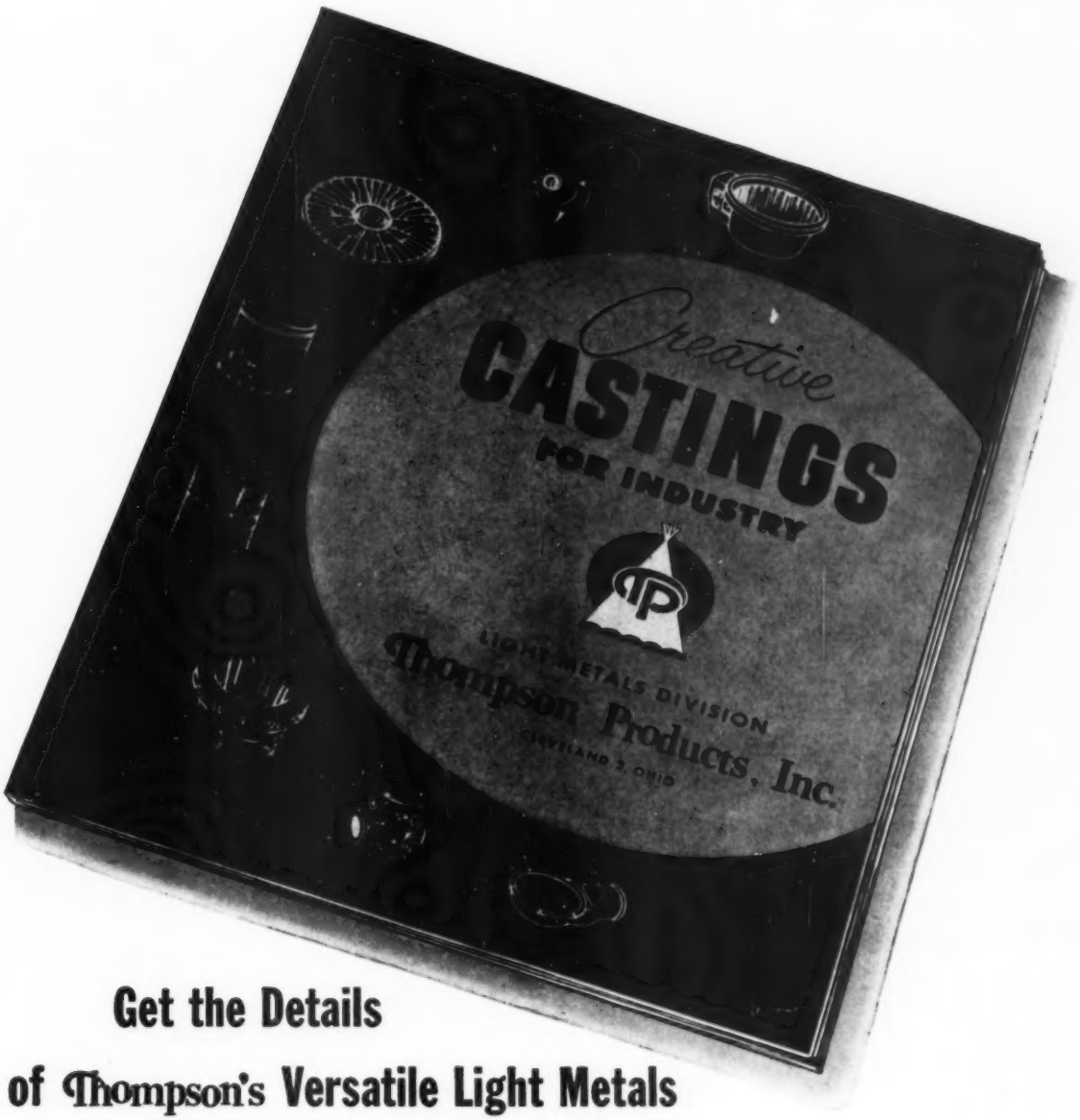
DIE CAST THREADS save machining of bicycle part





UPPER and lower spring plugs used on the floating spring-action of a bicycle well illustrate how a zinc die casting can solve a tough production problem.

If made from bar stock, there would be approximately a 50 percent loss of metal in addition to requiring a special set up to cut the non-standard thread, and a straddle milling operation to form the two flats. As a die casting, made by the Dollin Corp., the part is easily and simply made. Minimum secondary machining operations include reaming the bore and undercutting the shoulder for a lubricating washer. For appearance the upper plug is polished but gets no further surface finishing.



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MELTING PRACTICE for investment casting

Part Two

By SAM TOUR*

IN the first part of this report (PMM, October 1953, pg. 40) the author outlined background information concerning raw materials and melting equipment. Here he discusses melting contamination, melting losses, refractories and crucibles.

Melting Contamination

In all oil or gas-fired furnaces of the crucible type, it is necessary to maintain careful control of combustion and avoid gas absorption by the metal. Metals in the liquid state absorb gas quite readily. During solidification, this gas escapes from the metal and is trapped in the casting forming holes and intercrystalline porosity.

The structure of alloy metals which have been gassed during melting is non-uniform, the castings are mechanically weak and porous. It is, therefore, necessary to avoid the absorption of gas during melting or to develop some method of degassifying the metal in the molten state before pouring.

No truly satisfactory and successful method of degassifying has been developed. The best practice, therefore, is to avoid gassing of the metal and this is done by operating on the slightly oxidizing side. In other words, it is desirable to have a slight excess of oxygen present after combustion has been completed even though such an excess does tend to form oxides of the metals. It is a simple matter to deoxidize the alloys and, therefore, it is preferable to have molten metal contaminated slightly with oxides which can be removed rather than with gases which cannot be removed before pouring the metal into the molds.

In connection with indirect arc melting, the question of carbon pick-up has already been referred to.

In any type of furnace, the practice should be to melt as rapidly as possible and avoid undue exposure of the molten metal to contamination either from products of combustion or from furnace walls and linings or from crucibles. Metal in no case should be heated hotter than necessary for proper pouring of the castings to be made. The practice of materially overheating metal in a furnace and then cooling it by the stirring in of some scrap castings, gates or sprues or runners cannot be recommended. In any metal being melted, good melting practice is essential to obtain the best results.

One cannot expect to get clean metal out of a furnace and obtain proper life of crucibles or furnace linings in contact with the molten metal if sprues, runners, gates and scrap castings covered with adhering investment are added to the charge. This material forms a viscuous slag which not only cuts into crucible and furnace linings, but also tends to become entrapped in the metal as it is poured out, and thus results in slaggy castings.

In general it is necessary to use up sprues, runners, gates,

*Sam Tour & Co., Inc.

and scrap castings continuously as they are produced in the shop. Often, it is also desirable to use up turnings and borings as they are accumulated from the machining of castings. Some shops make a practice of recovering spills and particles of metal from floor sweeps and use this material also in their melts. The use of the latter type of scrap should be limited, however, as it is likely to contain an untold quantity and number of impurities.

The use of regular scrap such as sprues and runners, is quite necessary. These should be proportioned in proper ratio with new metal, either virgin or ingot metal, so that successive melts have about the same proportion of remelt as new metal. This will avoid erratic variations in castings produced from consecutive melts.

CHECKING TEMPERATURE of steel heat in a 12 KW tilting type furnace. Courtesy Detroit Electric Furnace Div., Kuhlman Electric Co.

Melting Losses

Allowance must always be made for losses of metals during melting. The amount of each of these which may be lost is dependent upon the nature of the charge, the type of furnace in which the charge is melted, the method of operating the furnace the temperature to which the metal is melted and the presence or absence of slag or charcoal or other protective agents on top of the metal Often the presence of small quantities of such film-forming agents as aluminum and silicon have an important effect upon the amount of metal which is lost during melting.

In view of all of these variables, it is not possible to give definite figures as to percentage losses which will occur for a given metal in all shops. It is often possible to give approximate ranges of expected metal losses for specific melting and pouring conditions. Obviously as the zinc content of an alloy is increased, the tendency to lose zinc by vaporization will increase and, therefore, the higher losses will be expected with the higher zinc brasses. Where oxidizing conditions are present, either intentionally or unintentionally, it will be expected that there will be some loss of copper and tin by oxidation.

In general it is best practice to provide for normal melting losses by making proper additions either to the charge or to the molten metal after the bulk of the charge has melted down. If furnaces are operated on the slightly oxidizing side as recommended, then the final addition made to the metal before pouring of castings should be one of a deoxidizing nature.

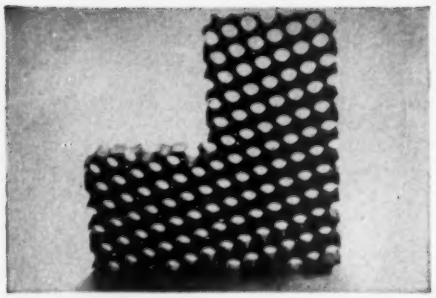
In the aluminum and magnesium-base alloys which are relatively self-deoxidizing, no deoxidization additions are used. Fluxes of various sorts are used occasionally. Treatments with nitrogen, chlorine or chlorine compounds are sometimes used.

In the copper-base alloys containing zinc, some zinc should be held aside and added to the molten metal when the metal is removed from the furnace in order to deoxidize it and at the same time make up for the zinc which has been lost. Where the alloys do not contain appreciable percentages of zinc, it is often desirable to deoxidize with phosphor-copper. In general, phosphor-copper is recommended as preferable to phosphor-tin for this purpose.

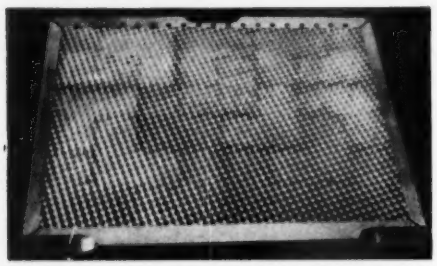
If tin and lead additions must be made to make up

continued on page 83

Here's a honey of

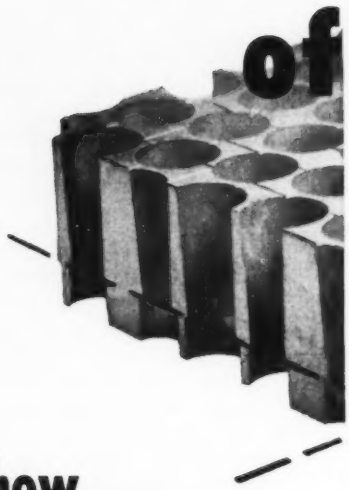


This is the "L"-shaped die cast unit just as it comes from Doehler-Jarvis machines. It is 5" x 5" on the long sides, 2½" on the four short sides and is ¾" thick. Prior to Base assembly at the Blatchford plant, flash is removed from the edges, and top and bottom are shaved slightly. No other finishing is needed . . . thanks to Doehler-Jarvis die-casting methods.



Here is a complete Blatchford "Honeycomb" Base with inside chase dimensions of 15" x 20". (Unit assembly of these Bases makes possible sizes up to 50" x 75".) It is made up of 16 of the angle blocks held together only by the enormous pressure of the chase bars — bolted at the corners — that frame the base. Surface of the form must be absolutely flat without even a few thousandths buckle or warp. Holes must line up precisely. Doehler-Jarvis die castings make possible perfect fit and virtually invisible joints in assembly of Base units.

Stonehands position and anchor printing plates on the "Honeycomb" Base with special catches that fit and expand in the holes. The thin walls of the Doehler-Jarvis castings have to be strong and solid to withstand both the locking pressure and the gripping forces exerted by the catch. When the plate mounting is completed, the entire "locked-up" form goes to the printing press.



and here's how Doehler-Jarvis perfect this

Before this intricate section was perfected, E. W. Blatchford Co. had to overcome some real production headaches.

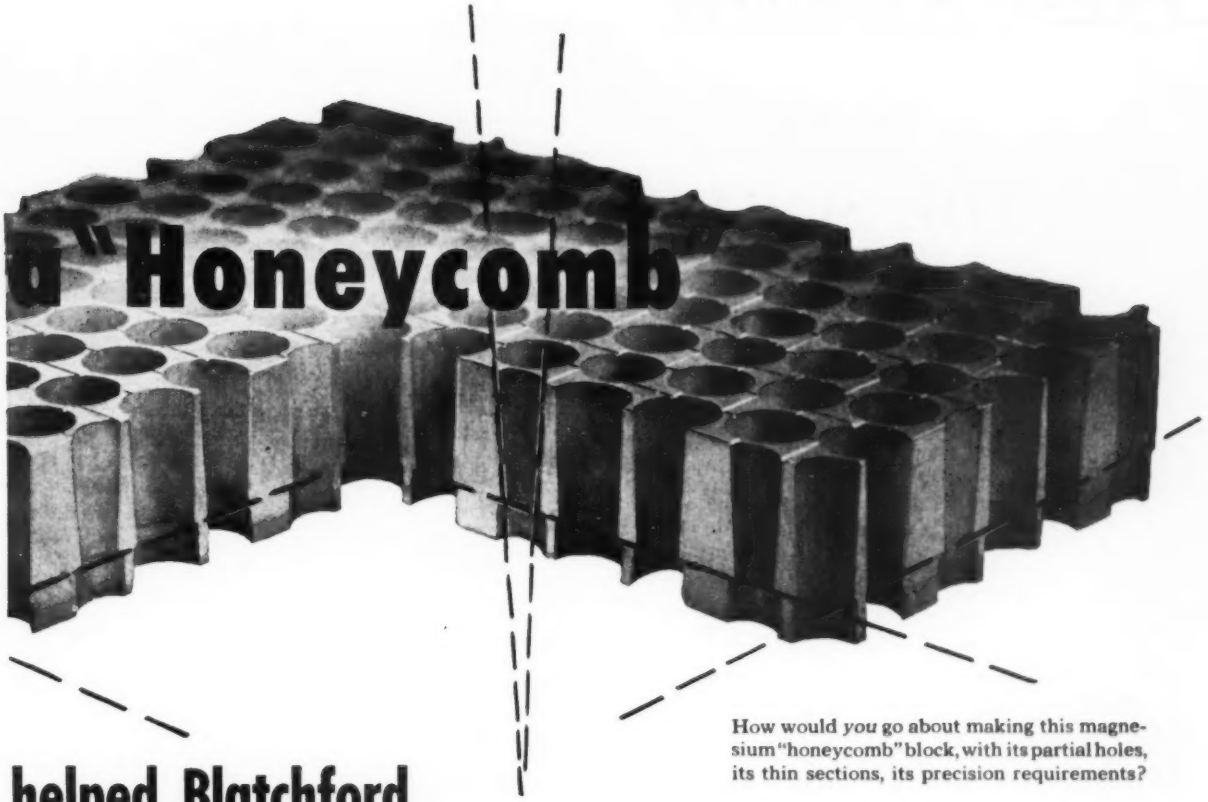
To machine their lightweight "Honeycomb" plate mounting system for printers would have been prohibitively costly. They would have had to remove 71% of the metal volume in the component blocks. And no one could agree on a way to form the partial holes along the "block" edges without running up rejects and tool breakage.

Then someone suggested die casting... a production technique that was just beginning to get wide attention 35 years ago. Die casting proved to be the practical answer but Blatchford engineers were still not completely satisfied. The behavior of the alloy was not always predictable and warpage of the "blocks" occasionally caused trouble.

Then Doehler-Jarvis entered the picture and worked the problem over with Blatchford people.

That did it. Quality went up and product performance improved. Over the years Doehler-Jarvis cast untold thousands of the "honeycomb" units. Printers bought Blatchford "Patent Base" like hotcakes... under Blatchford's 10-year guarantee.

Then, just a few years ago, Blatchford wanted to make the Base even lighter on men, even lighter on power, even lighter on presses. Again engineers from both companies joined forces. They put several light metal alloys to the toughest of tests.



How would *you* go about making this magnesium "honeycomb" block, with its partial holes, its thin sections, its precision requirements?

helped Blatchford complex component

A magnesium alloy finally was selected and Doehler-Jarvis designed and built a new production die.

Today, so precise is the Doehler-Jarvis casting technique, only 1/10 of an ounce – 1.82% of the as-cast weight – is removed in finishing the "Honeycomb" block. The new Magnesium Base weighs 72% less than the original Zinc Base. Needless to say, it too is winning its battle in the market place.

As one Blatchford executive puts it, "Doehler-Jarvis die castings helped get our Base over the hump in the first place, helped us stay competitive over the years, then helped us give the product a shot in the arm."

In its half-century of die-casting, Doehler-Jarvis has helped turn good ideas into metal for many producers, large and small – among them some of the best known makers of automotive, electrical, communication, household, office and other types of equipment.

When they come to Doehler-Jarvis, they know that Doehler-Jarvis can supply both the resources and the resourcefulness they need.

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THE SINTERING PROCESS
Part Two: Furnaces

By PHILIP R. KALISCHER
Associate Editor

Part 1 of this article[1] dealt with some of the more or less theoretical aspects of the sintering process as applied to the formation of usable articles by powder metallurgical methods. It was brought out that for any given powder or mixture of powders the factors which influence the properties of the final compact to the greatest extent are:

1. Particle size or size distribution,
2. Initial forming pressure,
3. Sintering temperature,
4. Time at temperature.

There are, of course, many other influencing variables, but the four given are probably of greatest importance and the most easily varied and controlled. The effect of initial forming pressure was discussed in an earlier article[2] dealing with powder metallurgical presses. The effect of particle size and size distribution will be considered in a future article. There are left, then, sintering temperature and time at temperature; or more broadly sintering furnaces which are discussed here.

AS is well known, a green compact consists of a group of discrete metal particles pressed against each other with sufficient force so that mechanical interlocking of the particles takes place. Such a compact usually has, in addition to the metal particles, some sort of a lubricant added to reduce interparticle friction and friction between the powder mass and the die walls. In addition some volatile constituent may be added to give controlled porosity; there is always air in either separate or interconnected pores and each metal particle has an oxide coating.

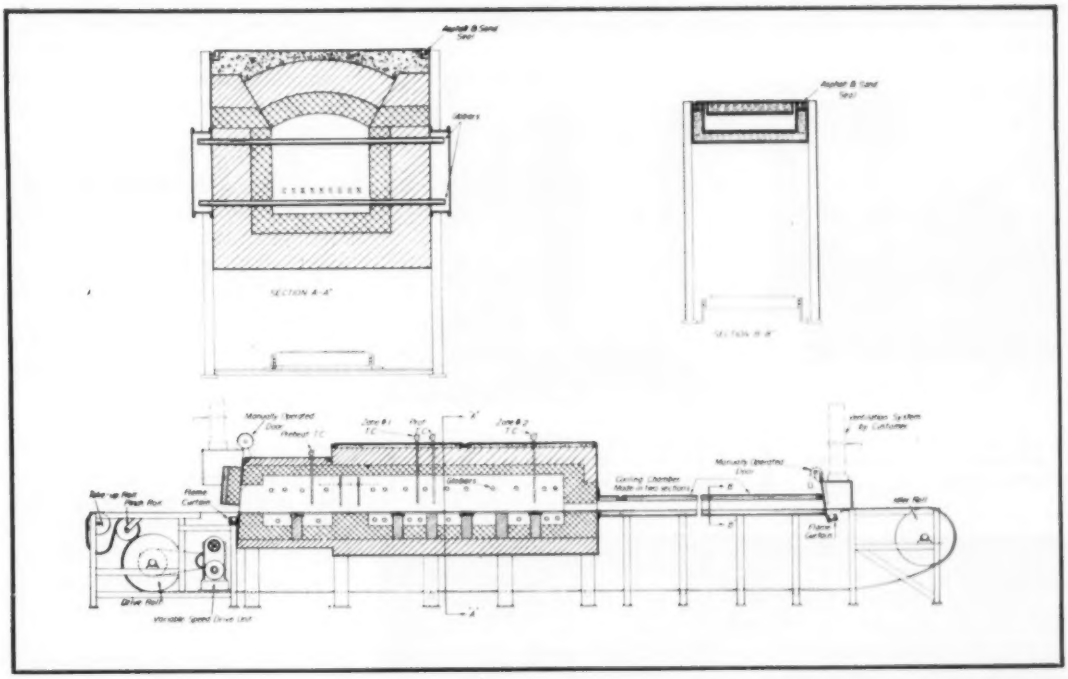
Considered as a whole then, a green compact is a heterogeneous mixture of metal, lubricant, possibly a volatile component, air and metal oxides, of these the only component that is desired in the final compact is the metal.

The function of the sintering furnace and its associated equipment is, therefore, to remove extraneous and undesirable components from the compact and to allow solid diffusion to take place to as great a degree as may be desired, depending upon the final properties desired. To accomplish this function the furnace proper is divided into three rather distinct zones: (see Figure 7) a pre-heat and purging zone, a sintering zone and a cooling zone. Each of these will be discussed separately.

THE PRE-HEAT ZONE

Since all of the deleterious components in a green compact are gaseous at the sintering temperature, it is essential that they be removed before sintering has progressed to such a degree that some of the pores, particularly the surface ones, become sealed off. Gas-

[1]Precision Metal Molding, Oct. 1953, pg. 58.
[2]Precision Metal Molding, Jan. 1953, pg. 80.



7. Cross section of a typical sintering furnace with the muffle removed. (Drawing courtesy Westinghouse Electric Corp.)

eous products evolved by the decomposition of lubricants and oxides must have a free path through the compact; otherwise swelling and bubbling will occur. It is particularly important also that the entrapped air be replaced with reducing gas, the normal furnace atmosphere, so that reduction of the oxide films can take place.

Since both the lubricant and any added pore-forming material will normally be decomposed at a relatively low temprature the primary function of the first section of the furnace is to replace oxidizing gases with reducing gases inside the compact. **As long as any oxide is present, solid diffusion can not take place across the oxide barrier.**

Another function of the first zone of the furnace is to sweep out all of the gaseous materials generated so that the atmosphere in the second or sintering zone of the furnace does not become contaminated.

Purity of the furnace atmosphere can not be over-emphasized. It avails little to generate an atmosphere that is substantially free of both water vapor and oxidizing constituents if this purity is not maintained in the furnace.

The temperature at which metal oxides will be reduced varies widely. For example, some of the more widely used metals have their oxides reduced in either carbon monoxide or hydrogen at the temperatures given in the Table 1.

This table assumes that the partial pressure of oxygen in the furnace atmosphere is zero, something seldom, if ever, achieved. Further, at the temperatures normally employed for sintering water vapor will decompose into hydrogen and oxygen so that the oxygen content of the water vapor must taken into account when determining the oxygen partial pressure of the furnace at-

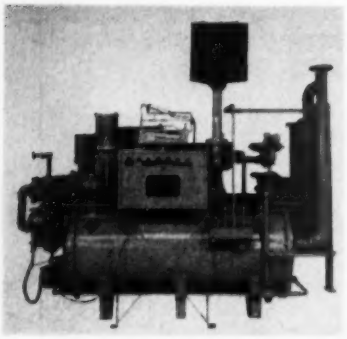
continued next page

TABLE 1

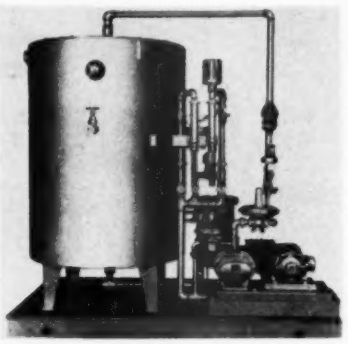
Metal	Oxide	Oxide reduced in H_2 or CO at deg. C.	deg. F.
Copper	**Cu_2O**	**(o) 155**	**311**
Iron	**FeO**	**(a) 330**	**626**
	Fe_2O_3	**(o) 950**	**1742**
Manganese	**MnO**	**(o)1200**	**2192**
Molybdenum	**MoO_3**	**(o) 500**	**932**
Nickel	**NiO**	**(o) 300**	**572**
Tin	**SnO**	**(a) 900**	**1652**
Tungsten	**WO_3**	**(o) 700**	**1292**
Zinc	**ZnO**	**(a)1100**	**2012**

(a) about, (o) over

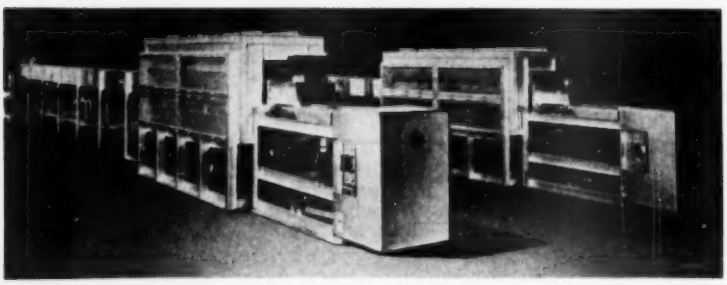
7. TYPICAL FURNACES and auxiliary equipment are illustrated below.



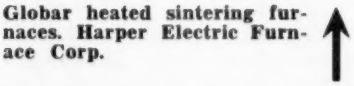
Inert gas producer for protective atmosphere generation. The Kemp Mfg. Co.



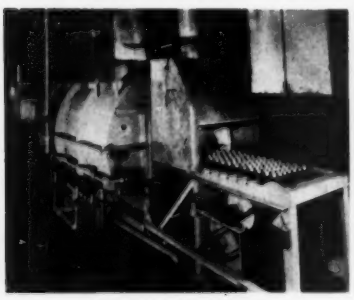
Gas generator for producing high CO content gas. Westinghouse Electric Corp.



Sintering furnace, gas fired with continuous wire mesh belt conveyor. Electric Furnace Co.

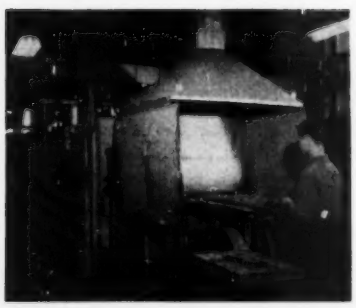


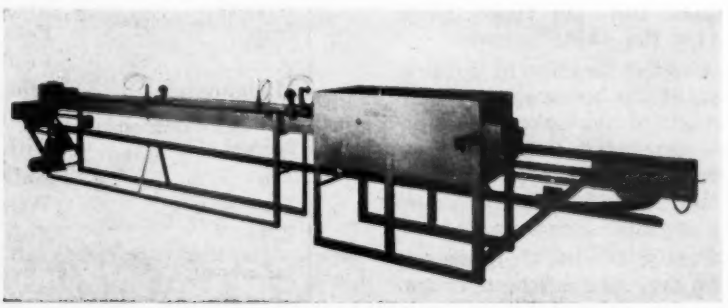
Globar heated sintering furnaces. Harper Electric Furnace Corp.



Electrically heated sintering furnace with chain belt conveyor. Westinghouse Electric Corp.

Gas fired sintering furnaces by Surface Combustion Corp.





mosphere, particularly since the decomposition of water vapor is accompanied by the formation of an oxide of the metal.

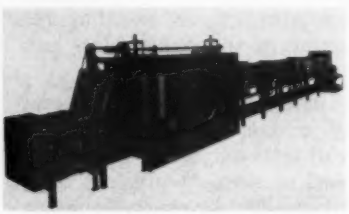
Gas flow in the purging zone must, therefore, be from the hot zone through the preheat chamber, or counter-current to the direction to movement of the charge. The flow of gas must also be sufficient to prevent back diffusion of contaminants into the sintering chamber.

Finally, there is one other source of contamination that must be purged in the preheat chamber. When the furnace is opened to admit the charge some air is always introduced. Many furnaces use a flame curtain over the entry to minimize this contamination, but there is always some and this air must be removed quickly by an outward flow of furnace atmosphere.

It is highly probable that more powder compacts are

continued on page 76

Chain Belt furnace, electrically heated, for powder metallurgical work. Lindberg Engineering Co.



C. I. Hayes Co. sintering furnace with chain belt conveyor.

EIGHT FACTS TO CONSIDER in specifying castings

By E. O. MILDEBRATH*

PROPERLY executed design for any machine component must take into account not only the functioning of the individual components, but also the method of manufacture. Without this latter consideration, design would be greatly simplified, but to put a machine on the market requires that the parts be fabricated in such a manner that the final cost be competitive.

Whenever possible, good design will permit manufacture by several different processes so that the production department will have some latitude. As a case in point, consider the group of permanent mold cast brackets shown below.

The shape of these parts makes one of the casting methods imperative, particularly since the brackets are specified as aluminum.

The production department is, therefore, faced with choosing the most economical casting method when the cost of the finished bracket, ready for installation, is considered.

Some of the factors which must be considered when deciding on a particular casting method are:

a. Cost of tooling to make the rough casting

b. Number of duplicate parts to be made.

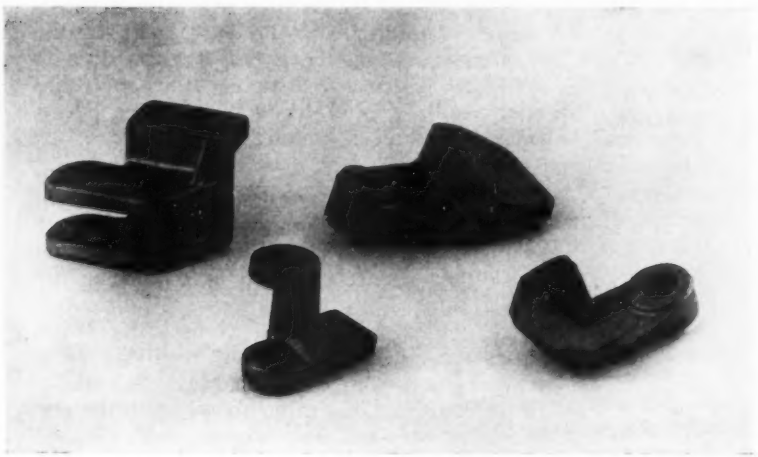
c. Cost of the rough casting

d. Cost of machining the casting.

e. Number of probable rejects developed during machining.

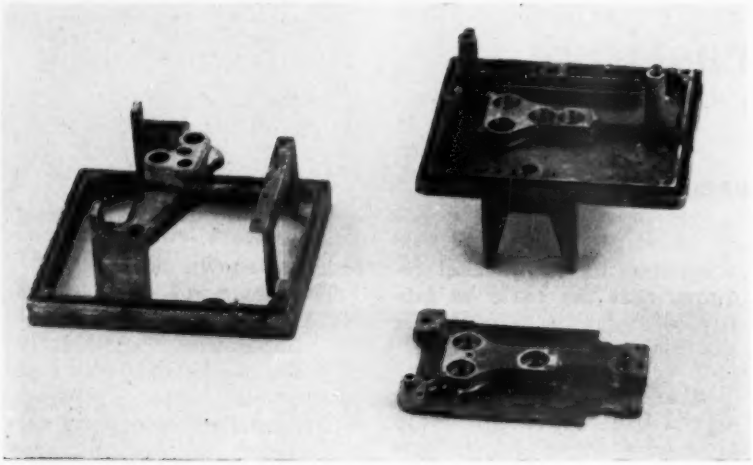
continued on page 94

*Chief Estimator, W. L. Maxson Corp., New York, N. Y.



Casting Method	Casting Tooling	Cost of Rough Casting	Cost of Machining	No. of Rejects	Cost of jigs & fixtures	Cost of Tooling	Cost of Surface Preparation
Sand	Low	High	High	High	High	High	High
Permanent mold	Low	Low	Low	Low	Low	Low	None
Die	High	Low	Low	Low	Low	Low	None

SHOCK-PROOF FRAMES . . . for precision instruments



BECAUSE they must operate as friction free as a finely jeweled watch movement, several of the interval timers built by the Curtis Development & Mfg. Co. of Milwaukee, Wisc., impose design and machining problems not frequently encountered.

With certain industrial measuring devices, such as a recording watt-hour meter, a jeweled movement can be used since the service requirements are such that the meter may be mounted in a reasonably shock-proof manner and, once installed, is seldom moved. A single adjustment, made in the factory, usually suffices for the life of the meter so that, except for those cases of accidental damage, the normally dust-proof case need never be opened. None of these conditions applies to the timers made by Curtis, yet they must perform with the same degree of precision and dependability as the meter noted above.

Because shock and vibration are not uncommon, and because the timer must be openable to change the interval settings, it has been found most practicable to use miniature sealed ball bearings for almost all applications. In many cases, the so-called precision bearings are used while in others the standard grade may be applied. Regardless, of which type of ball bearing is used, one major problem in design is alignment while another is rigidity of the mount. Both of these requirements are adequately met by using die cast aluminum frames shown above.

With precision requirements of the calibre needed in these mounting frames, it is obviously impossible to core the holes for bearings as accurately as they are needed. However, by holding the die cast parts to the smallest possible tolerances, it is possible to achieve a degree of coring accuracy such that only reaming is required to give the necessary degree of alignment.

One of the greatest advantages of an aluminum die casting is maintenance of alignment and operating distances over wide changes of ambient temperature. When assemblies of dissimilar metals are used as would be the case if a brass or steel frame were fabricated, there would always be some differential shifts due to bimetal action resulting from temperature changes. With a single casting, or two castings of similar metal as in the one case, this problem is overcome.

In many cases the timers are located in relatively highly corrosive atmospheres. Aluminum will tolerate these conditions without surface protection.

In any type of industrial measuring instrument, cost is, of course, a major consideration. Here again the aluminum die cast frames show their superiority. Not only is the first cost considerably less than a comparable frame made by other methods, but assembly of the instrument has been simplified through the use of these frames so that a major saving is possible all along the line.

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Die Cast Products, Inc.
Du-Wel Metal Products, Inc.
The Electric Auto-Lite Corp.
Falconer Metal Specialties Co., Inc.
Foster Consolidated Products Corp.
Glenvale Products Corp.
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Heick Die Casting Corp.
Indiana Die Castings, Inc.
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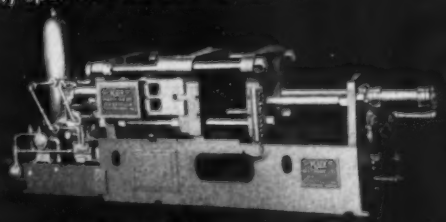

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THE METAL POWDER INDUSTRY*

Consumption of iron powder is 6 to 8 times as great now as in 1945; copper powder use has doubled, MPA Secretary reports.

By ROBERT L. ZIEGFELD
Secretary Metal Powder Association

REALLY powder metallurgy is very old. It was one of the first processes used for producing metal objects several thousand years ago. In those days furnaces could not produce enough heat to extract the higher melting point metals like iron from their ores by the fire metallurgy methods known today. However the metals could be reduced from their oxides as spongy granular masses in crude furnaces and then these pressed or forged while hot into useful solid shapes.

However, the really important development in the production of metal powders and useful articles made from them came in the twentieth century, with the last World War giving the metal powder industry special impetus. Tungsten filaments made by powder metallurgy for electric lamps was the first important development and this also applied to other refractory metals. Then after the first World War came the porous bearings. With their controlled porosity which can be impregnated with oil, they took a strong hold on the automotive industry which has a big need for small bearings in inaccessible places where oiling is difficult or impossible. These have also taken hold in many another industry, like the home appliance industry, with similar problems.

Then came another important development in powder metallurgy, probably familiar to all of you, cemented carbides for cutting tools, dies and other purposes where especially hard surfaces are required. These are generally made of tungsten carbide powders cemented or bonded by cobalt. This development has had great industrial significance, as you are no doubt aware.

Where powdered metal parts are used

Today powder metallurgy reaches into many industrial fields. Aside from the self-lubricating bearings, the refractory metals and the carbides already mentioned are many other highly important industrial applications.

In general, there are two broad fields where powder metallurgy is coming into its own. The first is to produce articles that can only be made by powder metallurgy because of the inherent characteristics of the process. The second is where it competes directly with other precision processes.

Some examples of the first have been mentioned, namely refractory metals and porous bearings. Other examples include making combinations of metals that do not readily alloy or of metals and ceramics. Filters having controlled porosity and often made of metals to resist specific corrosion conditions fall in this category, as do metallic friction materials for clutch and brake facings, widely used for heavy duty service but expanding into lighter service applications and automatic transmissions for automobiles. Many other examples could be cited.

In the other group are the thousands of structural mechanical parts used as components in all sorts of devices and formerly made by other well-known processes. In its simplest terms manufacture of such parts consists of pouring a powder or proper mixture of powders into the die cavity of a press, pressing at from 20 to

*Excerpts from a paper delivered before the American Society of Tool Engineers, Greater New York Chapter, September 14, 1953.

50 tons psi, sintering in a controlled atmosphere furnace at temperatures below the melting point of the metals, and re-pressing or coining when necessary to correct shrinkage or other dimensional changes that occurred during sintering. The process has the advantage of eliminating waste of metal, much if not all machining and a reduction in the number and complexity of manufacturing operations.

At first the process was applicable mainly to mass produced, broad dimensional tolerance and low strength parts. But rapid strides have been made and the field of application broadened. Responsible are improved powders and alloy powders, better presses and die design, carbide dies, and added operations like coining and infiltration with other metals. Tolerances now approximate those of most established production processes, and while limited to small parts originally, the size that can be economically produced has increased tremendously.

It is no panacea for all metal forming problems, but there are many, many places where it can reduce costs and speed production. Parts and dies must be properly designed. For instance re-entrant angles, holes at an angle to the direction of pressing, great differences in vertical and longitudinal dimensions have to be avoided. Some of these things can be added after the part is made, however, by a minimum of machining.

Large quantity production of comparatively small parts is ideal for powder metallurgy in its present stage of development. It is finding wide application not only in the automotive and home appliance industries, but in such varied industries as clocks and timing devices, locks, business machines, machine tools, aircraft, and the like.

A few examples may be enlightening. For instance at one of the annual meetings of the Metal Powder Association a couple of years ago, a representative of the General Electric Co. pointed out that the gearing mechanism which actuates the agitator in their automatic washing machine consists of a set of four gears up to 4 in. in diameter which are made of high-carbon, copper-impregnated iron powder having a tensile strength of 85,000 psi. These gears were previously machined from high strength steel In addition bronze self-lubricating metal powder bearings are used in practically all bearing surfaces.

The clock industry is another that has swung over heavily to metal powder parts. Parts for clocks and other timing devices must be made to

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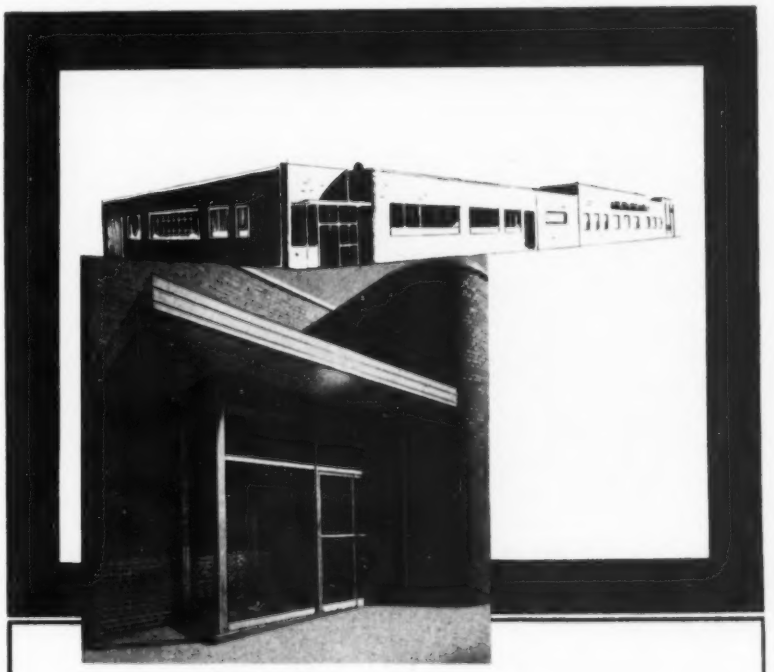

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close tolerances. Many gears, hubs and pinions in clocks have been replaced with oil-impregnated metal powder parts. The Lux Clock Manufacturing Co., for example, has found that it can only make larger savings in cost but the metal powder parts are actually out-wearing the parts previously employed.

One of the leading business machine companies, National Cash Register, has more than 90 different metal powder parts in production and still more than that number in process of tooling up for production. Many of these must resist considerable impact in use. That company is now producing metal powder parts at a rate of over 36,000,000 a year.

Growth of industry outlined

Now a few words to give you an idea of the scope of the industry today. Practically all metals are now being made into powders by a variety of processes such as hydrogen reduction, electrolysis, atomization and others. The most important powders volume-wise are iron copper, brass and aluminum. But many others, like stainless steel, titanium, tungsten, tin and lead, are also important although volume may be considerably less.

To give you some idea of the growth of the industry, **copper powder is currently being used at more than twice the rate it was in 1943.** Most of this growth has been for self-lubricating bearings and mechanical parts, and for friction materials.

Iron powder has shown more phenominal growth. About twice as much domestically produced iron powder was used in 1952 as in 1944. However, in 1944 practically no iron powder was imported. Since the war, however, large tonnages have been imported, mainly from Sweden and also from Canada, so that **we now estimate the iron powder actually consumed in the United States to be in the neighborhood of six to eight times what it was in 1944.**

Another way to look at iron powder growth is through capacity. A survey made by the Metal Powder Association last spring revealed that iron powder production capacity in the United States and Canada was a little over 1,100 tons per month. However, additional capacity then under construction was about twice that amount, so that by next year capacity in this country should exceed 3,000 tons a month. Some of this additional

continued on page 93

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PMM

Finishing Section

SURFACE FINISHING

Most precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating, or chemical coating. This section includes information on the methods, processes and equipment used in these surface treatments.

A Section Devoted to Specialized Finishing of

Die Castings • Investment Castings • Powder Metal Parts
Permanent Mold Castings • Plaster Mold Castings

1. USING A COATED ABRASIVE belt running on a polishing lathe and a wall mounted backstand idler to polish flash off die cast vacuum sweeper parts.

Here's how you can

Convert a Polishing Lathe To Use Abrasive Belts

By J. J. DURNAN*

NEED for simple but complete instructions on how to convert a polishing lathe from using set-up wheels to coated abrasive belts has become apparent. Reports from the increasing number of manufacturers in both metallic and non-metallic fields, indicate the rapidly spreading interest this finishing medium has generated.

In answer to this need Behr-Manning Corp. has detailed a conversion procedure which will insure good belt tracking, and a practical range of machine flexibility (changes in contact wheel sizes and belt lengths) on existing equipment. Time to make a conversion need not exceed one hour, and extra material — contact wheel, backstand idler and belt — will cost about $100. The improvement in operator comfort, speed of stock removal, quality of finish produced and rate of production possible will be apparent almost immediately and will soon cancel the cost of installation.

Selection of equipment

New equipment required in the conversion includes a contact wheel (or belt back-up wheel), a backstand idler pulley and a coated abrasive belt. For recommendations on best polishing or grinding techniques an application engineer in the coated abrasive industry should be consulted. He can recommend specific belt speeds, grits, lubricants and contact wheel densities for a particular job. However, for test purposes the following general rules will suffice.

Contact wheels, usually manufactured of compressed canvas or rubber, are available in a wide range of densities (hardnesses). Hard density wheels permit a fast rate of stock removal while soft density wheels are used for producing fine finishes and contour work.

Belt selection depends on the results desired and the hardness of the material. For fast stock removal, coarse grit belts are required, and for finishing, fine grit belts. In general, 24 to 60 grit belts are recommended for rough grinding, 80 to 150 grit belts for intermediate polishing and 180 to 500 grit belts for finish polishing. Cloth-backed belts coated with aluminum oxide grains are preferred for metal. Belts coated with aluminum oxide or with garnet abrasives are preferred for wood sanding. A grease lubricant is necessary for polishing aluminum and similar

*Behr-Manning Corp.

soft non-ferrous metals and will also improve finishes on steel.

Backstand idlers are the adjustable idler wheels that maintain belt tension and control belt tracking on the contact wheel. Several types of idlers incorporate a means of adjusting and controlling belt tension and tracking from the operator's normal working position.

From polishing lathe to backstand belt unit: 6 steps

Below is outlined a six-step procedure for converting existing equipment to use coated abrasive belts. Preliminary preparations include removing the old set-up wheel, and checking the spindle for excessive runout and wear. If the spindle does not run true or is worn the contact wheel cannot run true. For best polishing results this contact wheel must run concentric.

STEP ONE Mount the new contact wheel on the spindle in its permanent position and tighten the spindle nut.

STEP TWO Calculate the center distance between the center of lathe spindle and the center of the idler pulley shaft using the following formula*

$$\text{Center distance (C. D.)} = \frac{\text{belt length}}{2} - \frac{(D+d)\pi}{4}$$

D = diameter of the contact wheel.
d = diameter of the idler pulley.

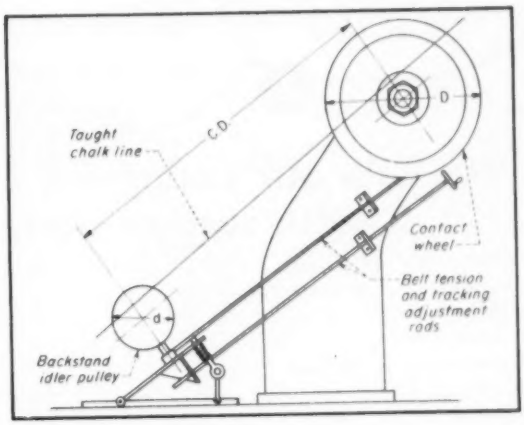
Place the backstand idler on the floor behind the lathe in approximate alignment with the contact wheel and at calculated center distance as shown in Figure 2. The belt tension adjustment on the idler unit should be adjusted to its center position.

STEP THREE Run a chalk line to the outside rim of the contact wheel and extend the line across the wheel to the idler pulley. The line will contact surfaces

***STANDARD BELT LENGTHS**

Belts of standard lengths (given below) should be used where possible because they cost less and are more readily available than belts of special length. Install your Backstand Idler Pulley so you can use coated abrasive belts of the following dimensions which are stock design:

Length	Width
48"	2½"
60"	2½"
118"	4"
132"	3" & 4"
138"	3" & 4"
148"	3" & 4"
168"	3" & 4"



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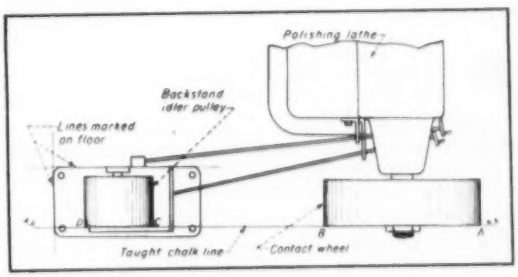

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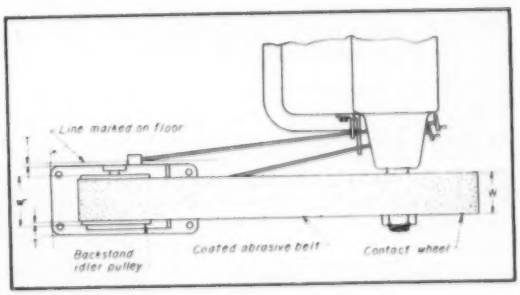

4.

A,B,C,D see Figure 3. After aligning the edges of the pulley and the contact wheel with the taut line, mark the position of the backstand idler on the floor as indicated. When aligning the two wheels, the tracking

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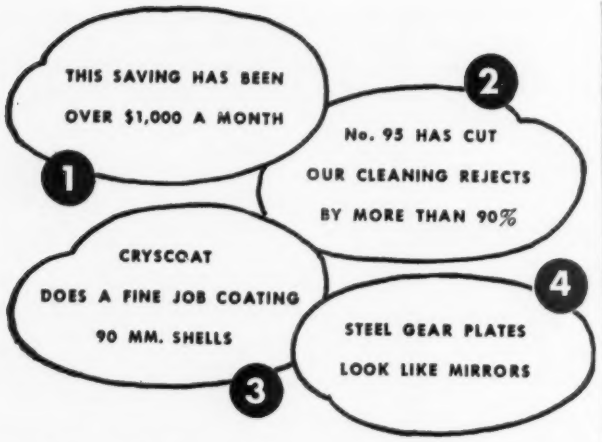

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Every day 200 Oakite Technical Service Representatives use Oakite cleaning materials and methods to help thousands of Oakite customers accomplish metal-cleaning jobs that are important parts of big production operations.

When a busy customer sends a few words of appreciation, we treasure those words as a *success sentence* that we have helped write in his *success story*. Here are brief explanations of the *success sentences* quoted above:

1. After 6 months use of Oakite Special Protective Oil for preventing rusting, this manufacturer of precision steel parts estimated savings at more than $6,000.
2. The use of Oakite Composition No. 95 for conditioning zinc-base die castings before plating cut cleaning rejects for this hardware manufacturer and showed other "very fine advantages."
3. Oakite CrysCoat HC put a heavy phosphate coating on 385,000 shells with "absolutely no trouble" according to a munitions maker, who added that "maintenance and control are very easy."
4. For burnishing, "Oakite Composition No. 3 is here to stay" says this maker of aircraft instrument parts, who adds "Pinions are polished to the roots of the gears. Magnesium parts are brilliant."

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FREE Ask for our booklet "*Some good things to know about Metal Cleaning.*" It discusses our methods for:

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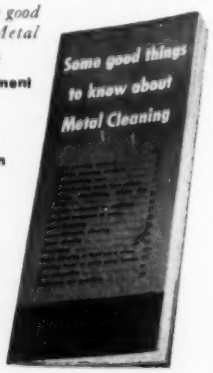

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adjustment must be placed at its center position to permit equal left and right side movement for belt tracking.

STEP FOUR If the idler pulley is wider than the contact wheel, move the idler pulley assembly as shown in Figure 3 a distance (T) equal to one half the difference in widths $\frac{(w-W)}{(2)}$. With the idler set in this position spot holes on the floor for fasteners.

STEP FIVE Remove the idler unit and drill holes for expansion shields or other fasteners appropriate for securing the unit in position.

STEP SIX Bolt the unit in position, place the coated abrasive belt over the contact wheel and idler pulley. Adjust tension and tracking controls.

Many times operating conditions dictate that the backstand idler pulley be placed either on a wall behind the polishing lathe

5. MOUNTING a coated abrasive belt on back stand idler. The spring loaded idler assembly maintains belt tension. A handle on the idler bracket permits manual compression of the spring to shorten the center distance between the wheels for installing the belt.

or even on the ceiling. Regardless of idler position, modifications of this procedure can be adapted to specific requirements of a particular installation.

A new coated abrasive belt polishing conversion in a metal finishing department will soon convince the user of its practicality.

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Die-pointed and augur-like for thicker metal (.050" to .200"), Central Type "B" Tapping Screws pass through a hole in one piece, form their own threads to lock both parts securely. For porous castings, non-brittle plastics, fibre and asbestos materials.

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Recommended for general use in metals from .030" to .100" thickness. Standard pitch thread interchangeable with standard machine screws. Ideal for chip-free assemblies. Second assemblies can be made on projected end of the screw.

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The 1953 way to chromium plate

WHAT PLATERS LOOK FOR IN RECTIFIERS

All platers want a DC supply to be dependable, equipment durable, and capacity close to needs in order to avoid extra investment.

Designed specifically for platers, in a line unsurpassed for completeness, Unichrome Rectifiers permit virtually a "custom" rectifier installation. Included are standard units, plus-rated units, extra heavy duty units and water-cooled units —available in sizes from 250 to 10,000 amperes in 250 ampere steps and with various controls. Full data available.

What to look for in chromium plating anodes

Quality of chromium plating anodes can be gauged by several important factors.

First is composition of the anode. If it's tin-lead alloy, it better resists corrosive action of chromic acid during both idle and active periods.

Then check the bond between body and copper hooks. Best conductivity results when hooks are tinned, alloy cast to the hook, and anode body then fused on.

Finally, observe the hook. Does it assure good contact with a knife-edge wedge-type hook that cuts through encrustations on anode bars?

Providing users with all these advantages, Unichrome Anodes for chromium plating make for efficient service with unusual economy.

Tantalum coils reduce costs in acid plating baths

More and more plating plants are now reaping benefits from a metal that seems made to order for heating or cooling acid solutions. With Unichrome tantalum coils, they get equipment immune to all commonly used acid plating baths. The metal has high heat conductivity and resistance to thermal shock. Its corrosion resistance and hardness permit use of thin wall sections to further increase its good heat transfer.

Result: A smaller coil does a better job than bulkier coils made of other materials—and with a minimum of trouble and maintenance. This saves on replacement and loss of production during downtime. Write for literature.

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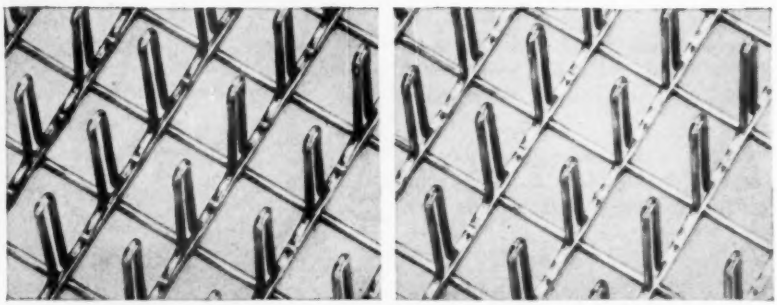
Many former operating difficulties eliminated with Unichrome SRHS Solution . . . users verify various benefits



(Left): Photograph of dish drainer basket plated in ordinary chromium solution. Dark areas at base of wire fingers show no coverage of nickel.

(Right): Same product when plated in SRHS Chromium Solution. Note the even color at top and base of finger—evidence of complete coverage.

More than 700 commercial installations of the Unichrome SRHS Chromium Solution are now in operation. These have provided working demonstrations that ordinary chromium solutions, unchanged since development in 1925, are virtually obsolete.

Briefly, the striking improvements stem from several important characteristics of the SRHS bath. Namely, its higher cathode efficiencies; its self-regulation of important chemical constituents which helps maintain optimum plating balance; and its wider bright plate range. These have benefited platers in various ways. For example:

20% to 80% FASTER PLATING

With an SRHS Solution, one plater was able to speed up an automatic machine. Plating work in 2 minutes 25 seconds instead of 3 minutes 38 seconds, he not only increased the machine's capacity 33% but also improved quality by exceeding thickness specifications.

Another company needed additional tanks to handle increased production of plated cutlery. Just by using the SRHS Solution, existing capacity was stepped up and the expense of new equipment saved.

BETTER COVERAGE

Photographs above show wire baskets used in dishwashers. Ordinary chromium couldn't cover this complicated shape but the SRHS Solution plated the work completely.

The solution has wider bright plate range. SRHS Chromium, therefore, not only means less "missing" but also less "burning." Consequently, it assures fewer rejects.

MORE WORK WITH LESS CURRENT

Finishing automobile bumpers, one company could plate only 8 on a rack in the ordinary solution. Requiring less current, SRHS Chromium permitted plating 9 bumpers per rack – or an 11% increase in production with no change in equipment.

A plant plating cigarette lighters in the ordinary solution was behind schedule due to limited current. Switching to SRHS Chromium, they found it possible to plate the same work load with ½ less current and in ½ the time.

SELF REGULATION SIMPLIFIES PROCEDURE

A printing company installed an SRHS Solution for chromium plating rotogravure cylinders. They had no previous chromium plating experience. Despite this lack, the SRHS Bath enabled them to plate 2800 cylinders with only 5 rejects.

★ ★ ★

With results like these, it no longer pays to work with a chromium solution of the "1925 vintage." Learn how to convert your plating operation without disrupting production. Detailed technical information available. Or call in a United Chromium engineer for complete facts.

For additional information Circle No. 33 on the Reader Service Card

New Allied Research Sales Rep.

Allied Research Sales Corp., a subsidiary of Allied Research Products, Inc., manufacturers of Iridite protective finishes and APR plating chemicals, has appointed Tom Richards as its representative with headquarters at 426 Transportation Bldg. Cincinnati, Ohio.

MACHINE TOOL REPLACEMENT DISCUSSED

A definite plant program for replacing machine tools and productive equipment is necessary to keep down costs according to Carl M. Beach, vice president of Cincinnati Milling and Grinding Machines, Inc.

Emphasizing that such a program requires foresight and detailed analysis by top management, he stated, "No live industry can keep pace with the advance of technology without continuous renewal and transformation of its productive facilities. Any equipment which does not meet the challenge of new and more modern machines must be displaced, regardless of its age or condition and whether it is physically worn out.

"A re-equipment policy that fails to give full recognition to obsolescence is bound to lead to abnormally high production costs and inefficiency. Because new equipment costs too much to discard existing facilities every time there is an advance in the arts, the installed capacity of industry necessarily lags. The problem is not to eliminate the lag but to hold it to the lowest limits that are economically justified."

NICKEL CONTROLS OFF NOV. 1

With military and atomic energy requirements fully covered, Commerce Secretary Sinclair Weeks has directed Business and Defense Services Administration to revoke its controls over the distribution of nickel and its use in the civilian economy. The order, revoking NPA Order M-80, is effective November 1st.

The action freeing nickel for civilian use was taken after the findings of the commerce department were approved by Arthur S. Flemming, director of the Office of Defense Mobilization.

DR. BLUM AWARDED MEDAL

An Elliot Cresson Medal, awarded by the Franklin Institute for distinguished contributions in the realm of physical sciences, will be presented to Dr. William Blum, former Chief of the Electrodeposition Section of the National Bureau of Standards.

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What's more, Hydro-Finish saves you more money because it saves time and labor! Operated by one man, a Pangborn Hydro-Finish machine removes scale and discoloration in *minutes* instead of hours. And, cleaned surfaces are virtually free of directional grinding lines, eliminating or reducing further finishing operations.

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NEW PRODUCTS

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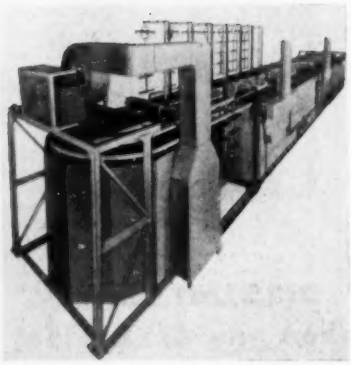

AUTOMATIC PLATING UNIT
. . . has unique material transfer system

A new automatic electroplating machine, which has now been thoroughly tested in production, has no elevating super structure, no transfer cams, no chains or sprockets and no hydraulic fittings above the tanks. The Lisowski transfer and conveying principle, around which the machine is built, has but two reciprocating movements, longitudially and vertically, eliminating many complicated motions which have been accepted as necessary in all previously produced automatic plating machines.

All working parts are mounted on a central carriage which moves on a single track and is actuated by any hydraulic cylinder. Basically this supplies the horizontal motion to the work through the cleaning and plating tanks and drying oven which surround the carriage. A shaft running the length of the carriage, near its top, is fitted with gears which are meshed to racks on the work lifting arms. This assembly provides the vertical motion which lifts and lowers the work out of and into the tanks.

Wagner Brothers, Inc.

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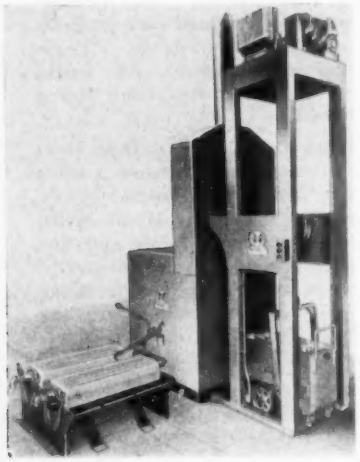

SOFT METAL MELTING UNIT
. . . is virtually fully automatic

An improved melting and loading unit which renders the remelting operation almost entirely automatic is now on the market. The unit is a complete, compact, self-contained device for remelting soft metals such as zinc, lead, lead alloys, babbit, solder and tin.

Square in design, the furnace requires less floor space than the conventional round type and is more easily adapted to fit a given area. The bottom-pouring spout, loading cover and accessories such as power agitator, hand pumps, water-cooled ingot molds, loading device, etc. may be located on either side, or rear to meet special requirements.

Automatic temperature control and pre-heating time switches are optional features available at extra cost. When desired, the furnace may be supplied without the bottom pouring valve for plants where hand ladling or pump casting is required. Standard models are available with pot capacities from 600 lbs. to 5 tons, and special models having greater capacities are available on special order.

Nolan Corporation

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HYDRAULIC COMPONENTS
. . . complete line offered

A new line of hydraulic power accessories, said to be the most complete in industry, has been announced. One set of catalogs and one source is said to be sufficient for an engineer to lay out a hydraulic circuit to meet almost any requirement. In addition to a very large standard line of equipment, the company has facilities which will enable it to design and manufacture all types of special hydraulic equipment.

Hydraulic Press Mfg. Co.

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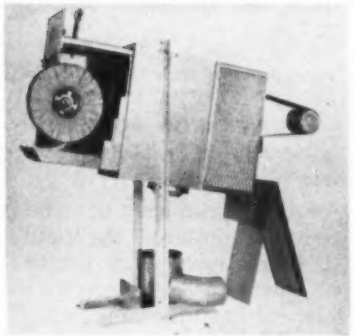
. . . for buffing lathes



A new-type of self-filtering hood, engineered for buffing and polishing wheels and belts, has been introduced. Utilizing a new principle, dust is withdrawn and controlled by the wind created by the revolving buffing or polishing wheel or belt.

Known as the Elim-O-Dust, the hood is designed to remove minute amounts of dust and dirt down to 0.02 micron in size. It is claimed to save up to $800 in heat, power, maintenance and space costs in a period of ten yars. Snagged parts are deflected by the air foils preventing serious injury to operators.

The universal hood can be adjusted to any height spindle and to any angle. It is designed to accommodate straight back or floor level back stands for polishing belts. The standard hood will accommodate wheels up to 18" diam. and 9" wide.

Slonneger Products Co.
For more information Circle No. 199 on the Reader Service Card

PHOSPHATE COATING FOR STEEL
. . . for corrosion protection

Phosphate coatings used on steel surfaces to improve corrosion resistance and to provide better paint bonding are the newest members in the family of metal cleaning and metal preparation compounds.

Used for paint bonding, the coating provides a strong bond for the organic finish and prevents corrosion under the finish. In other applications, such as on ordnance items, phosphate coatings are used alone to protect parts from corrosion and wear.

The new line includes iron phosphate, zinc phosphate, manganese phosphate coatings.

Pennsylvania Salt Mfg. Co.
For more information Circle No. 206 on the Reader Service Card

PRESSURE TESTING MACHINES
. . . for detection of leaks

A new line of vertical, pressure testing machines that detect and locate leaks in castings as well as in brazed, welded and soldered assemblies has been announced.

The machines are air-operated and electrically controlled to subject the parts to a ten second automatic check in which the part (or any specified area in the part) is

continued next page

extreme flexibility
makes this new
BECKETT AIR THRUST
DRILLING & TAPPING MACHINE
ideal for Die Casters

- Single and multiple tapping **direct** from chuck or any standard drill head without clutch or lead screw. **Exact** thread reproduction in die casting alloys.
- Controlled air thrust provides **correct** drilling and tapping action — completely variable and quickly adjustable approach speed, return speed and working thrust.
- **Quick change-over** from drilling to tapping or allied operations and from light to heavy work.

BECKETT Air Thrust Drilling and Tapping Machine, with electrically controlled "Hi-Cyclic" air feed, performs single and multiple tapping without employing a clutch or lead screw. Absolute and precise control of the air thrust at low pressures provides extremely sensitive tapping action. The tap provides its own lead and reproduces a thread with maximum fidelity to the ground tap. A Class 4 fit has been produced in magnesium.

This is a rugged, accurate machine, with heavy base, box column and gibbed ways for sliding head and adjustable work table. Available in models for drilling only and for drilling and tapping. Bench and floor types and table multiple unit combinaticns for continuous line production.

You can **triple** your drilling and tapping production — at **great savings** — with the new Beckett Air Thrust Drilling and Tapping Machine. The investment is **low** — and deliveries are **good!**

MODEL C-16-T

Electrically Controlled
Hi-Cyclic T. M. Reg.
AIR THRUST

Max. thrust — 980 lbs. at 100 psi
Stroke — 4" (6" available)
Capacity — Drill ¾" in mild steel; tap 1½" N.C. with 1½ h.p. motor.

Write TODAY for Complete Details and Your Copy of BULLETIN NO. 50

BECKETT-HARCUM CO. INC., 1088 Wayne Rd., Wilmington, Ohio

For additional information Circle No. 59 on the Reader Service Card

charged with a given volume of air. Loss of air pressure indicates a leak or a flaw in the various parts under test. Indication of leakage is by signal light through an extremely sensitive measuring system.

The machines can be set up for single or multiple unit testing and are so arranged that any station will operate regardless of the other stations in a multiple arrangement. Operation of the machine is from 80 psi air source and a 110-volt line. Precision pressure gages in the cycle control panel permit individual control of each station.

Hautau Engineering Co.
For more information Circle No. 198 on the Reader Service Card

HUB-TYPE CUT-OFF WHEEL . . . reinforced, resinoid type

An improved reinforced, resinoid hub-type cut-off wheel designated as model BFR, replaces one with the same designation which has been on the market. Longer life is the main feature of the improved wheel.

Tests show that increased life of up to a third more than the former wheel can be expected with the same quality of cut.

Norton Co.
For more information Circle No. 210 on the Reader Service Card

HIGH PURITY IRON POWDER . . . introduced by west coast source

Another producer of iron powder has entered the field with a relatively high purity iron powder. The powder available has the following average characteristics.

Analysis:

Total iron	98.50%	max.
Insolubles	0.45	max.
Hydrogen loss	0.50	max.
Others	0.55	max.

Apparent density 2.3 — 2.5 g/cc, Flow 35 sec. max., screen analysis 100% through 60 mesh, 20 — 40% through 325 mesh. Tensile strength 95 g/cu. in., 13,000 psi for straight iron sintered, elongation on above tensile specimen 3% in one inch.

Tacoma Powdered Metals Co., Inc.
For more information Circle No. 213 on the Reader Service Card

DRILL AND TAP MACHINES . . . for multiple holes

The line of heavy duty X drilling and tapping machines equipped with electrically controlled air-powered thrust has been announced. Two models are currently being produced: one an air-thrust drilling machine, and the other an air-thrust drilling and tapping machine. Both units are available as floor, bench and multiple unit combinations.

The model illustrated is designed primarily for production multiple drilling and tapping in a wide range of sizes. It puts relatively short-run jobs into the high production class because of the ability to drill and tap from one fixture.

The unit performs single and multiple tapping direct from the drill chuck or standard multiple drill head, without clutch or lead screw.

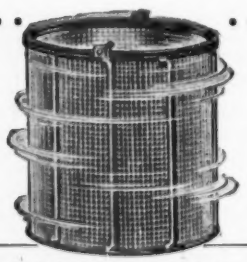
Beckett-Harcum Co., Inc.
For more information Circle No. 197 on the Reader Service Card

DRIES SMALL PARTS *Faster–Better..*

DOES IT FOR LESS!

Kreider Dryer with auxiliary gas heating unit (illustrated). Auxiliary steam heating unit available; also standard model without auxiliary heating.

Basket (shown below). Heavy gauge steel woven mesh over steel frame. Capacity, 1140 cu. ins.



Spin-Dries* up to 50 pounds in less than 2 minutes

Simple design . . . careful engineering, sturdy construction assure trouble-free, low-cost maintenance operation. Operates at 625 r.p.m. on less than 1 h.p.

No scarring or marring . . . with Kreider Dryer. Centrifugal force holds parts immovable in basket . . . assures smooth, evenly dried surfaces, long-lasting luster, minimum "rejects".

One man runs it! Standard model Kreider Dryer occupies less than 6 sq. ft. floor space. One man tends—loads, unloads—keeps production moving, prevents expensive, time-wasting tie-ups.

See for yourself! Write Dept. PR 113 today for illustrated 4-page folder . . . also addresses of installations near you.

New Holland Machine Co., New Holland, Pa.

***Only 2 simple steps required . . .**

(1) Operator places wire mesh basketful of small parts in Dryer . . . turns motor "ON."

(2) Operator turns motor "OFF" . . . presses foot brake . . . removes basket.

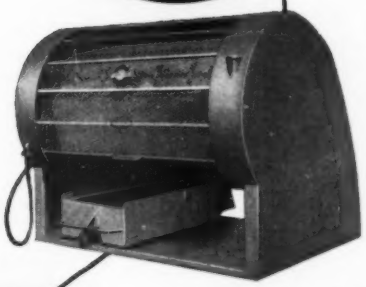
NEW HOLLAND *KREIDER* DRYER

For additional information Circle No. 60 on the Reader Service Card

Come to TUMBLE GRAV-I-FLO FINISH for ALL your tumbling needs!

You can get complete equipment and supplies for faster, better tumbling at Grav-i-Flo. This authoritative tumbling source can furnish you, from its years of experience, the correct answer to any tumbling problem.

Larger capacity machines take 31% to 80% more work-load in same floor space. Improved cutting materials shorten cutting cycle by 15% to 25%. Grav-i-Flo installations substantially reduce capital investment, floor space, and production time!



Model 66", two compartments

Model 48", two compartments

MACHINES

Grav-i-Flo 66", 48" and 36" machines have cam locked doors with manually released safety stops; available with unlined or rubber lined cylinders, constant or variable speed drive, J.I.C. controls, and timers from 5 minute to 20 hour cycles. Equipped with electric wiring and water piping installed ready for plant hook up.

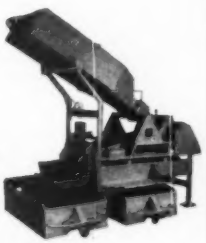
Model 36", two compartments

Model 24", two compartments

Designed For Small Lot Production and Laboratory Processing.

ACCESSORIES

Two deck parts-and-chips separator and chip grader



Occupies less floor space. Separates parts quickly without impingements. Grades 3 sizes of chips simultaneously.

Other Grav-i-Flo accessories include tubular yoke hoist pans, chip pans, wash-out doors, screens, chip bins, unloading boots, dip tanks.

Chips and compounds

Grav-i-Flo natural and synthetic deburring and finishing chips and highly developed compounds consistently outperform every type of tumbling process offered on the market.

Investigate!

Grav-i-Flo superiority in equipment and supplies has been proved to hundreds of users in many different industries. Let us show you, too, at no obligation. Our representative will visit your plant, or send samples direct to us. Engineering Service available to all users.

SEND FOR CATALOG showing complete line of Grav-i-Flo equipment, accessories and supplies.

THE GRAV-I-FLO CORPORATION

Dept. PM-11 400 Norwood Avenue

STURGIS, MICHIGAN

For additional information Circle No. 31 on the Reader Service Card

REFERENCE MATERIAL

Catalogs and data offered free in this month's ads; to receive copies circle number on reader service card.

1. TO SOLVE DIE LUBE headaches, a reprint & a company bulletin are available from Acheson Colloids, giving data on their die casting lubricants.
5. DIE CASTING MACHINE catalog from Cast-Master describes their line of machines.
6. TO IMPROVE PLANT SAFETY, a booklet on non-flammable hydraulic fluids that are recommended for die casting machines is offered by Celanese Corp. of America.
7. DIE CASTING MACHINE catalog from Cleveland Automatic Machine Co. gives performance data and other information about their machines.
8. ACCUMET PRECISION investment castings that reduce machining time and extend product life are the subject of literature offered by Crucible Steel Co. of America.
10. SMALL PARTS BULLETIN and samples are available from Dollin Corp., zinc and aluminum die casting company.
11. HOOVER DIE CASTINGS are presented in a booklet from the Die Casting Div. of Hoover Co., describing the facilities and the castings produced.
13. HOW INVESTMENT CASTING Gives You New Design Freedom is the title of an 8-pg. booklet offered by Howard Foundry Co.
14. DIE CASTING MACHINES built by Hydraulic Press Manufacturing Co. are presented in a catalog giving full data.
15. USE OF INVESTMENT castings to reduce costs is subject of a booklet, "A Machinist's Nightmare Becomes a Designer's Dream" published by International Nickel Co.
16. DIE CASTING MACHINES are the subject covered in catalogs made available by the Kux Machine Co.
17. POWDERED METAL PARTS producing facilities of their Metallurgical Products Div. are presented in a booklet from Thompson Products.
18. DIE CASTING MACHINE catalog from Lester-Phoenix introduces an entire line of machines for making die castings.
20. DIE CASTING MACHINES built by Lewis Welding & Engineering are presented in a brochure offered by the company.
24. CONVEYOR-LINE FOUNDRY of the Light Metals Div., Thompson Products, is featured among plant views included in a new brochure the company has published on their facilities for producing die castings and permanent mold castings.
27. HOW TO CONTROL HEAT in sintering and heat treating furnaces is the subject of an engineering data booklet "Harnessing Heat," from Westinghouse.
29. ABRASIVE GRAINS for finishing . . . how to use the right grain in the right way . . . is the theme of a booklet, "Abrasive Grains and Powders" from the Carborundum Co.
30. THREAD CUTTING SCREWS of many types for a variety of metals and purposes are covered in literature available from Central Screw.
31. TUMBLING EQUIPMENT, together with a full line of accessories and supplies, is compiled into a catalog showing the full line of Grav-I-Flo barrel finishing products.
32. PLANNED ASSEMBLY making effective use of self-tapping screws is explained in a guide book issued by Parker Kalon.
33. WAYS TO IMPROVE chromium plating operations through the use of Unichrome SRHS chromium solution, and other materials and equipment are made available by United Chromium.
34. WHERE PLASTER MOLD castings are used in industry is told in a booklet published by Atlantic Casting & Engineering. Booklet includes data on alloys cast.
37. TO BRIDGE THE GAP between ordinary powdered iron parts and the high alloy steels, Metal Hydrides produces pre-alloyed chromium-nickel alloy powders, described in a technical bulletin.
38. DIMENSIONING DIE CASTINGS is a special subject covered in a guide book from Newton-New Haven, commercial die casters.
41. BEARINGS FOR EVERY purpose, in standard and special shapes, can be found in the catalog of the Wakefield Bearing Co.
42. PROTECTIVE FINISH for metal that can be applied at room temperature without electrolytic apparatus is described in literature from Allied Research.
43. PREVENTING THREAD stripping in die cast metals and other materials is explained in literature from Groov-Pin discussing their Tap-Lok inserts.
45. DIE CASTING facilities of Advance Tool & Die Casting Co. are illustrated in a brochure offered by the company.
49. SMALL DIE CASTINGS weighing ½ ounce or less are presented in a brochure from Gries Reproducer, specialists in small zinc die castings. Sample castings are available.
50. NEWSY REPORTS and current information about their die casting & other non-ferrous alloys are contained in The Henning Messenger, a house organ of Henning Bros. & Smith.
53. HOW TO DESIGN for aluminum & magnesium die castings can be learned from a brochure offered by Litemetal Dicast.
55. COMPLETE ENGINEERING, die making & die casting facilities of Paramount Die Casting Co. are presented in descriptive brochure.
58. MACHINES FOR MAKING plastic patterns to be used in investment casting are described in a catalog offered by Van Dorn Iron Works.
59. GANG DRILLING & TAPPING to save money in machining die castings can be accomplished with machines described in literature from Beckett-Harcum.

continued on page 65

REFERENCE MATERIAL — cont.

continued from page 64

60. DRYING SMALL METAL parts by use of a special spin-drying procedure that takes only two steps, is described in a brochure from New Holland Machine Co.

61. GOOD THINGS TO KNOW about cleaning metal parts is the subject matter of a useful booklet published by Oakite.

62. DIE CASTING MACHINES for producing small die castings are presented in a catalog from A. B. C. Die Casting Machine Co.

63. ALLOYS FOR INVESTMENT casting are introduced in a leaflet from Cannon-Muskegon.

71. STAINLESS STEEL LADLES for die casting and permanent mold casting are described in literature from Spin-Craft.

73. LONGER LIFE for dies through wet blast cleaning and maintenance of surfaces, is the subject of literature from Pangborn Corp.

75. A MANUAL of investment casting published by Jelrus Precision Casting Corp. describes applications of investment castings and gives critical data.

76. HOW TO IMPREGNATE castings to eliminate porosity is the subject of a booklet from Metallizing Company of America.

78. WAYS TO CUT FASTENER inventories are pointed out in an engineering bulletin and data book from Reliance Div. of Eaton Mfg. Co.

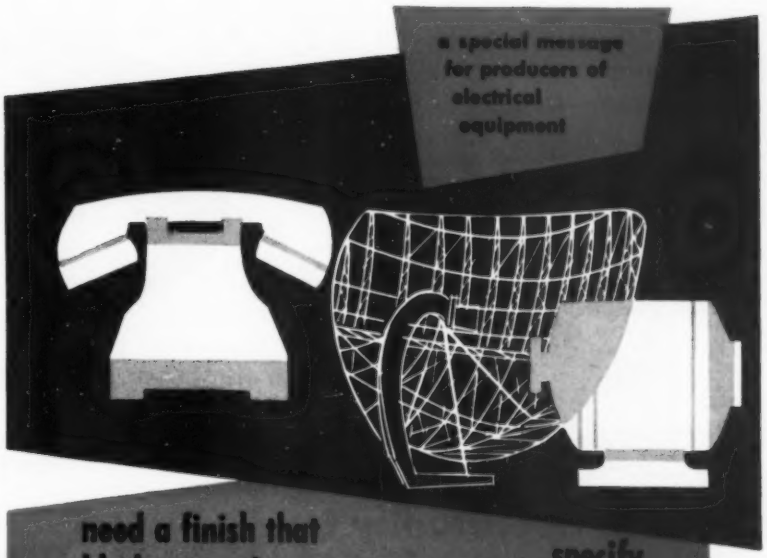
79. DEBUR HOLES ON a drill press, as described in literature giving full details on NoBur tools.

80. HIGH SPEED TAPPING heads are the subject of a booklet from Procunier Safety Chuck.

82. DIE CASTINGS that are special . . . or run-of-mine . . . can be made by Racine Die Casting Co., whose facilities and typical castings are included in a brochure offered by the company.

83. CURE THAT FINISHING department bottleneck with barrel finishing methods. A 52-pg. catalog from Almco Supersheen tells how to do it.

84. SOLID CARBIDE MILLS and other die maker's tools are included in the Severance "All Star" catalog.



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Here's peak corrosion protection combined with conductivity, weldability and solderability. Here's a finish that holds paint firmly, prevents underfilm corrosion. Here's a line of attractive final finishes to add quality and sales-appeal. Here's Iridite . . . and here's how you can use it:

ON ZINC AND CADMIUM you can get highly corrosion resistant finishes to meet any military or civilian specifications and ranging in appearance from olive drab through sparkling bright and dyed colors.

ON COPPER . . . Iridite brightens copper, keeps it tarnish-free; also lets you drastically cut the cost of copper-chrome plating by reducing the need for buffing.

ON ALUMINUM Iridite gives you a choice of natural aluminum, a golden yellow or dye colored finishes. No special racks. No high temperatures. No long immersion. Process in bulk.

ON MAGNESIUM Iridite provides a highly protective film in deepening shades of brown. No boiling, elaborate cleaning or long immersions.

AND IRIDITE IS EASY TO APPLY. Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

WANT TO KNOW MORE? We'll gladly treat samples or send you complete data. Write direct or call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.

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small in size but

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in opportunity for SAVINGS

Just figure your assembly expense as compared to total production cost, and you'll see why. In some products it runs as high as 75%.

Cutting assembly costs is Parker-Kalon's specialty. You get a two-way savings. First, the Self-tapping Screw method, originated by P-K, permits you to save by eliminating needless operations. Second, with certified Self-tapping Screws of P-K guaranteed quality, you can make sure *planned* savings *pay off* on the assembly line.

A P-K Assembly Engineer will be glad to help you start making savings you've been missing. He'll call at your request. Parker-Kalon Corporation, 200 Varick St., New York 14.

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Filled with facts you need to make sure of a two-way saving when you plan assemblies. Ask your P-K Distributor, or write Parker-Kalon for Form 475-D.

**This mark △ on every P-K Self-tapping Screw identifies it as genuine.*

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USEFUL LITERATURE

To receive copies of the publications described here circle key number on reader service card bound in this issue.

PROCESSES

Shell Molding Machine: 144
A machine that is claimed to bring shell molding within the reach of every foundry is described in a brochure from the Sutter Products Co.

How Magnets Are Made: 145
Applied Magnetics for June 1953 describes the various steps in the manufacture of Alnico magnets. Copies are available from Indiana Steel Products.

Analysis of Gases in Metals: 146
Vacuum fusion analytical work for the determination of gases in metals is described in literature available from the National Research Corp.

Investment Castings: 147
How investment castings are made and typical parts made by the process are detailed in a brochure available from the Jelrus Precision Casting Corp.

Precision Aluminum Castings: 148
"Creative Castings for Industry" tells the story of the permanent mold castings and die castings made by the Light Metals Div. of Thompson Products, Inc.

MATERIALS & EQUIPMENT

Burners and Accessories: 152
Leaflets describing line burners, filters, valves and pumps have been published by Eclipse Fuel Engineering Co.

Wear Strips: 153
A complete line of investment cast Ampco Bronze wear strips, drilled or undrilled are described in a leaflet from Cadmet Corp.

Inspection Equipment: 154
A new illustrated four-page bulletin giving complete specifications on a line of dial gages, cylinder bore gages, comparator and bench gages is available from DeWitt Equipment Co.

Die Lubricant for Powder Metallurgy 155
The use of lithium stearate as a powder and die lubricant is discussed in the latest issue of Foote Prints available from Foote Mineral Co.

Casting Plaster: 156
A controlled porosity casting plaster particularly suited for molds to use in casting metal is described in the Hydrocal Craftsman published by U. S. Gypsum Co.

Inspection Light: 157
A description and application of an inspection light for inspecting small holes are contained in a bulletin from American Cystoscope Makers, Inc.

Lubrication of Machine Tools: 158
Machine tools—their uses and lubrication—is the subject of a new booklet just issued by the Shell Oil Co.

Pyrometer Data Book: 159
A 42-page data book and catalog of Wheelco instruments and accessories is available for those concerned with the solving of process control problems. The information is published by Wheelco Instruments Div. of Barber-Coleman Co.

Horizontal Extrusion Presses: 160
A new eight page bulletin on horizontal extrusion presses has been published by Lake Erie Engineering Corp.

Metal-to-Metal Adhesives: 161
A new technical bulletin, No. P-151, has been issued by Monsanto Chemical Co. describing the use of polyurethanes as adhesives for bonding rigid materials, such as metal-to-metal and glass-to-glass.

Casting Alloys: 162
A wall chart listing the compositions, specification designations, nominal designation, etc. of brass, bronze and nickel silver alloys is available from Henning Bros. & Smith, Inc.

Brass and Bronze Ingot: 163
Kramer Alloy News, a house organ of H. Kramer & Co. gives information on the company's brass & bronze ingot, including such material as comparable specifications, etc.

FINISHING

Protective Coating for Aluminum: 166
Zincilate, a new type of protective coatings which can be used on a variety of iron, steel and aluminum products, is described in an illustrated brochure just published by Industrial Metal Protectives, Inc.

Bright Nickel Plating Development: 167
Hanson-Van Winkle-Munning Co. has announced a new bright nickel plating method said to be a marked advance over other and older processes. The new method is fully described in literature available from the company.

Preparing Steel for Painting: 168
In a nine-page, illustrated booklet, Oakite Products, Inc. describes "How to apply better zinc phosphate coatings to steel in preparation for painting." The booklet presents a concise story of the advantages of phosphate coatings.

Dust and Fume Eliminators: 169
What is described as a new type of vertical rotor wet dust and fume eliminator is described in a bulletin issued by Schmieg Industries, Inc.

Thread Chart: 171
A plastic chart having tap size, tap drill and body drill sizes as well as decimal equivalents is available from Reiff & Nestor Co.

Complete Barrel Finishing Story: 172
In a 51-page booklet, Almco Supersheen describes in detail and illustrates barrel finishing in all of

continued next page

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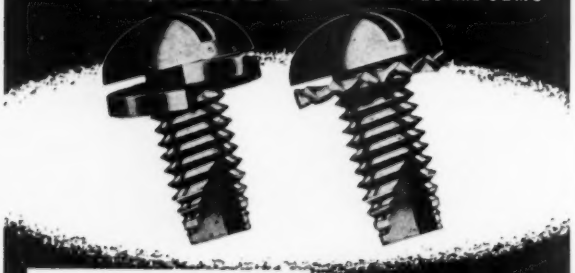
• ELIMINATE TAPPING COSTS
• REDUCE ASSEMBLY TIME
• BALANCE INVENTORIES
WITH RELIANCE "THREAD CUTTING" SPRINGTITES and SEMS



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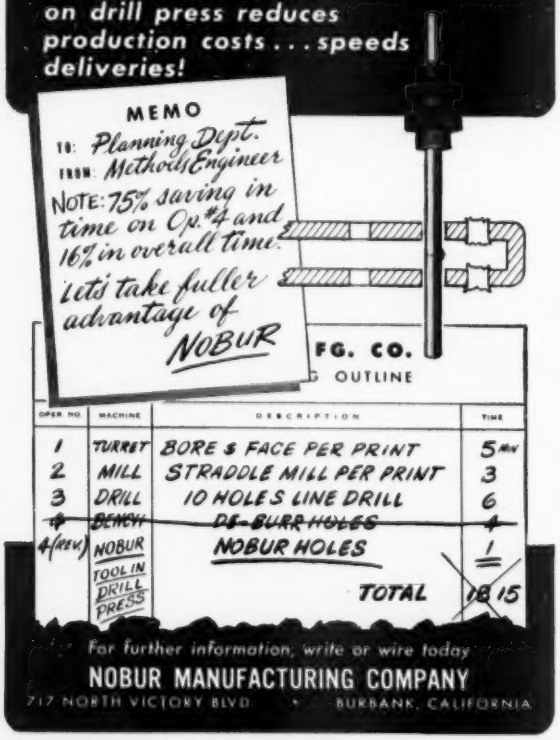
Deburring with NOBUR tool on drill press reduces production costs . . . speeds deliveries!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2 | MILL | STRADDLE MILL PER PRINT | 3
3 | DRILL | 10 HOLES LINE DRILL | 6
~~4~~ | ~~BENCH~~ | ~~DE-BURR HOLES~~ | ~~4~~
4 (new) | NOBUR TOOL IN DRILL PRESS | NOBUR HOLES | 1
TOTAL | 18 15

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USEFUL LITERATURE — continued

its ramifications. Both machines and compounds are described and listed.

Lapping of Die Castings: 173
Machines and equipment for lapping a wide variety of parts, including die castings, and the job lapping department that is now set up, are described in Grits and Grinds, published by the Norton Co.

Sensitive Drill Presses: 174
A bulletin describes the supersensitive, small hole drilling and tapping machines made by the Hamilton Tool Co.

Vapor Degreasing Solvent: 175
A highly stable solvent for vapor degreasing that does not break down to give possible acid formation and which is easily reclaimed by distillation is described in literature from G. S. Blakeslee.

Automatic Compound Application: 176
The application of buffing compound by a completely automatic air operated compound applicator is illustrated and described in a bulletin from George L. Nankervis Co.

Rapid-Heavy Duty Cleaning: 177
For cleaning zinc base die castings and all other types of metals except aluminum, the new L P cleaner is recommended in a descriptive booklet issued by Cowles Chemical Co.

Barrel Finishing Compounds & Barrels: 178
A case history brochure describing Lorco compounds and equipment for barrel finishing is available from Lord Chemical Corp.

HERE'S THE "tap miser" YOU'VE BEEN WAITING FOR!

Helps eliminate costly tap breakage shut-downs and excessive work spoilage!

Breaking too many taps?—Tap life shortened?—Spoiling many pieces?—Then check your tapping equipment. Investigate PROCUNIER Tapping attachments. Whether it's continuous or intermittent tapping in soft or hard metals—large or small hole jobs with skilled or unskilled operators—you will find Procunier Tapping machines performing with a new-found ease, a more dependable and consistent accuracy and providing many extra hours of tapping efficiency.

Procunier Tappers include: cover clamping and quill models mount rigidly eliminating chatter and vibration; new, sensitive double-cone friction clutch automatically regulates driving pressure with a soft "cushioned" action; ballbearing; heat treated gears with special reversing mechanism; unique tap holding spindle support; aluminum housing; plus other important features.

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Dept. 11

Please send your illustrated brochure giving complete details, specifications and prices on the improved line of Procunier High Speed Tapping Heads.

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The exclusive Procunier "Tru-Grip" tap holder is lighter, smaller in diameter. Eliminates "chewed" tap shanks.

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SAFETY CHUCK COMPANY
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CHEMICALS ACP PROCESSES

PHOSPHATE COATINGS TO MAKE YOUR PRODUCT DURABLE*

PIONEERING RESEARCH AND DEVELOPMENT SINCE 1914

For more than a third of a century, ACP research chemists and ACP technical representatives in the field have pioneered in the science of metal preservation. They have developed surface treating chemicals which either protect metals directly, or create a superior bond for decorative and protective paint finishes, and now, ACP chemicals and processes are being used the world around to reduce costs, speed production and add to the life-span of countless products.

ACP metal protective chemicals include: protective coating chemicals for steel, zinc and aluminum; metal cleaners and rust removers; final rinse controls; pickling acid inhibitors; copper coating chemicals; soldering fluxes; alkali cleaners and addition agents; copper stripping and brightening solutions.

PAINT BONDING

"GRANODINE"® zinc phosphate coatings improve paint adhesion on automobiles, refrigerators, projectiles, rockets, and many other steel and iron fabricated units or components.

"LITHOFORM"® zinc phosphate coatings, make paint stick to galvanized iron and other zinc and cadmium surfaces.

"ALODINE"® protective coatings provide improved paint adhesion and high corrosion-resistance for aircraft and aircraft parts, awnings, wall tile, signs, bazookas, and many other products made of aluminum.

RUST PROOFING

"PERMADINE"® zinc phosphate coatings provide rust and corrosion proofing for nuts, bolts, screws, hardware, tools, guns, cartridge clips, and many other industrial and ordnance items.

PROTECTION FOR FRICTION SURFACES

"THERMOIL GRANODINE"® manganese-iron phosphate coatings provide both rust proofing and wear resistance — anti-galling, safe break-in, friction on rubbing parts.

IMPROVED DRAWING AND COLD FORMING

"GRANODRAW"® zinc phosphate coatings make possible improved drawing, cold forming and extrusion on such steel products as sheets for stamping, bumpers, parts to be formed, prior to plating or painting, cartridge cases, etc.

*Made, Sold, and Serviced By A Pioneer In Protective Coatings For Metals . . .

AMERICAN CHEMICAL PAINT COMPANY

***General Offices:* Ambler, Penna.**

Detroit, Michigan ***Niles, California*** ***Windsor, Ontario***

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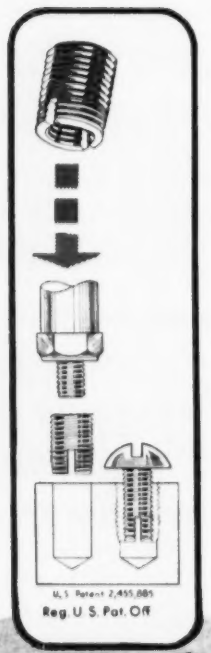
Threaded fasteners -- like trees -- need strong roots

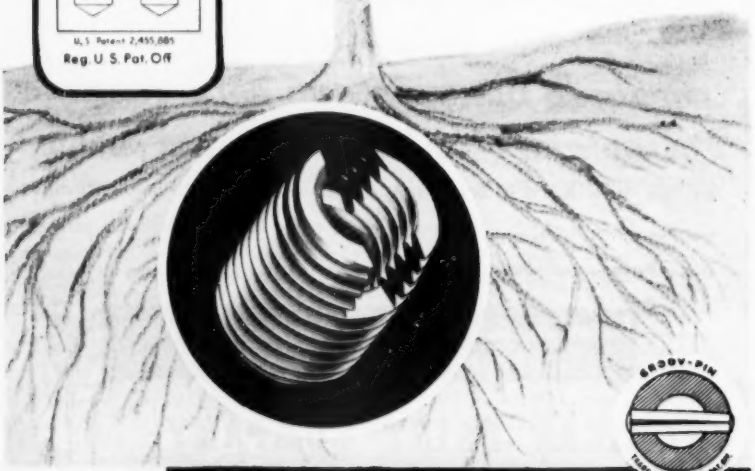


Threaded fasteners subject to stress and wear in non-ferrous materials, require some sort of hard bushing as a base for a tapped thread.

Among the various types of bushings available to a design engineer for use with aluminum, magnesium, plastics and similar materials, Tap-Lok Inserts are unique for simplicity and ease of installation and rigidity in use. Being self-tapping, they save the cost of the separate tapping operation and avoid the danger of crossing threads. Secondary operations are unnecessary.

The Insert withstands vibration without loosening and has maximum torque-and-pull resistance. It is completely free from the time-wasting failures of cast and molded inserts.

Tap-Lok Inserts are used in large volume as original equipment, in production salvage, and in maintenance. They are easily inserted with a simple driving tool operated by hand or power.



Send for descriptive folder

Also manufacturers of Groov-Pins for positive locking press fit.

GROOV-PIN CORPORATION

1122 Hendricks Causeway Ridgefield, New Jersey

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OPPORTUNITIES

INDUSTRIAL SALES — FOUNDRY EXPERIENCE

Large national organization has excellent sales opening for a man with foundry and/or die casting experience in the light metals industry. Engineering degree preferable. Must have salesmanship ability. Please forward complete details including foundry experience, age, salary requirements to Box 11153, Precision Metal Molding Magazine.

FOR SALE — New Kux K-5, with Wheelco Electronic heat controls and gas burner system. Save $1000 on this 24 oz. (zinc) die casting machine. Write M. Dale Newton Co., P. O. Box 929, Medford, Ore.

DIE CASTING MACHINE FOR SALE: Aluminum cold chamber machine. 400 ton Hannifin hydraulic clamp. Equipped with 6" tie bars, 14" x 34" between bars, 30" x 52" platens. For immediate delivery F.O.B. our plant in Chicago. Priced right for quick sale. Write Box 11253, Precision Metal Molding magazine.

COOPER ALLOY ENGINEER LOANED TO GOVERNMENT

The Cooper Alloy Foundry Co., Hillside, N. J., has announced that the services of their chief engineer, Percy C. Shaffer, are being loaned to the Government for six months to assist the National Production Authority in the job of allocating nickel.

MINNESOTA MINING EXPANDS

Expansion of the distributor organization for "Honite" barrel finishing abrasive chips, compounds and equipment has been announced by Minnesota Mining and Manufacturing Co.

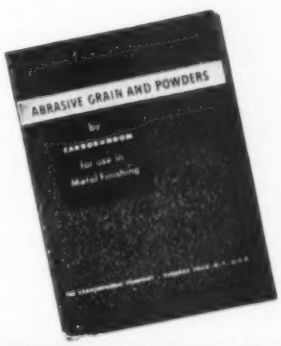
"To date twelve distributors have been appointed in major industrial centers — the nucleus of a distributor organization designed to eventually make "Honite" sales and service available in every important metal finishing center in the country", according to John S. Coppage, merchandising manager for "Honite".

There's ONE Grain HERE that's right for YOU

...are you using it?

GRAIN TYPE	CHARACTERISTICS	PRIMARY USES
ALOXITE TP Aluminum Oxide	Tough, blocky. Standard grit sizes from 16 through 220.	Polishing operations involving heavy stock removal on steel and other high tensile strength metals.
ALOXITE TPT Aluminum Oxide	Tough, sharp. Grits 16 through 100.	Polishing operations involving removal of large amounts of metal (e.g. plowshares).
ALOXITE TPL Aluminum Oxide	Very sharp, friable. Grits 16 through 220. (It fractures during use, thus reduces loading of the wheel surface).	Polishing low tensile strength metals—copper, brass, bronze, aluminum.
ALOXITE TPC Aluminum Oxide	Medium sharp. Grits 16 through 220.	General purpose polishing grain—for removal of small amounts of metal.
ALOXITE TPW Aluminum Oxide	Powder. Grits 240 through 1000.	As the abrasive in paste heading of polishing wheels and belts.
CARBORUNDUM RA Silicon Carbide	Sharp, very friable. Grits 10 through 240.	Polishing cast iron.
CARBORUNDUM RA Silicon Carbide	Powder. Grits 280 through 600.	General purpose polishing.

HERE'S THE BOOKLET that tells you everything about the finishing of metals with abrasive grain and powders ... how to size, cast and cure your polishing wheels—how to recondition used wheels, etc. Also full discussion of metal buffing, tumbling, blasting and litho plate graining with abrasives by CARBORUNDUM. Send for your copy today. No charge—no obligation. Just write to Dept. PM–83-51



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"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company, Niagara Falls, New York

For additional information Circle No. 29 on the Reader Service Card

Die Cast

ALUMINUM and MAGNESIUM SPOOLS and BOBBINS for SHIPPING and PROCESSING WIRE and TEXTILES

Industrial uses and applications of parts manufactured from die cast aluminum and magnesium are almost limitless. These new light weight alloys offer through the die casting process great savings in time, materials and much of the labor otherwise required for machining and finishing. In addition, the savings in weight often effect reductions of shipping costs.

Illustrated here are some of the spools and bobbins die cast by LITEMETAL in single units from aluminum and magnesium. Our extensive experience in the production of these spools and bobbins has proved their efficiency and economy for the processing and shipping of wire and textiles.

Let's Talk It Over . . .

LITEMETAL DICAST, INC. is an organization of specialists — men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs — little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large cable spools. Complete facilities for secondary operations are also available.

Write today for literature and design information. Quick action on inquiries.

LITEMETAL DICAST, Inc.

A DIVISION OF HAYES INDUSTRIES

1925 WILDWOOD AVE • JACKSON, MICHIGAN

PLANT AND EXECUTIVE OFFICES

For additional information Circle No. 53 on the Reader Service Card

FOOL-PROOF LOCKERS
continued from page 33

when the key is reinserted to unlock the locker.

It has two projecting lugs to locate the cam bushing which is responsible for accurate timing of each step in the locking sequence.

When this, and other lock components, were designed, first thought was given to function, and only then, to method of fabrication. However, American Locker Company, like other manufacturers, has to select fabricating methods which keep costs down. Perhaps the cost factor is not as critical as it is with highly competitive consumer goods, but we nevertheless are faced with cost problems.

Many of the components are as complex as the one described above. Some are more complex. It is apparent that to machine these from the solid or even to build them up from machined and stamped components would be far too expensive.

Severance CARBO-MILLS GROUND-from-the-Solid
The all-purpose CARBIDE mill at LOW cost. Use them same as you would High Speed mills or Rotary Files — Same machines — Same speeds (or higher). No more, time consuming, "kid-glove" care. Just chuck them up in your regular equipment and watch these RUGGED CARBO-MILLS go to work!
SOLID CARBIDE CUTTING HEADS
CARBO-MILLS ASK NO SPECIAL FAVORS
3/32" SHANKS
7 Standard Numbers, featuring REAL cutting teeth to remove stock faster over long periods of use—as well after regrinding as when new.
IN PORTABLE TOOLS
CARBO-MILLS by the ORIGINATOR of Ground-from-the-Solid Mills
1/8" SHANKS
12 STANDARD NUMBERS THE POPULAR WORK BENCH SET
NO PROBLEM OF TOOTH CHIPPING OR BRAZE-FAILURE
CARBO-MILLS PREFERRED BY OPERATORS!
IN MACHINE TOOLS
1/4" SHANKS
20 STANDARD NUMBERS
20 Standard Numbers (only 9 illustrated) cover the widest possible range of uses. Don't continue losing valuable time and money; replace your less efficient Rotary Files with these longer lasting, faster cutting, stamina possessing, CARBO-MILLS at the earliest possible moment!
LAST UP TO 75 TIMES LONGER THAN ROTARY FILES OF HIGH SPEED
DIE MAKERS! ASK FOR THIS SET
Furnished to you in a sturdy wooden case, Di-cor Set No. 40 is a set of 8, ¼" shank CARBIDE mills designed and instituted specifically for you, the Tool and Die Maker. Specially selected shapes - Special tooth patterns and cuts for all types of precision Tool and Die work. You will ply your skills easier and faster than ever before with these personal finishing mills. These CARBIDE mills need absolutely no coddling and will win their way to the the most favored spot on your Work Bench! Send for complete information and prices today! Ask for Leaflet No. 645
REGRINDING — Due to CARBO-MILLS being made of Solid Carbide repeated savings are made possible through successive regrinds.
INVESTIGATE NOW!
FOR COMPLETE INFORMATION AND PRICES SEND FOR BULLETIN C-M.
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732 IOWA AVE., SAGINAW, MICH.
You Should Have A Severance "All Star" Catalog
A Copy Is Yours For The Asking
GROUND from the Solid

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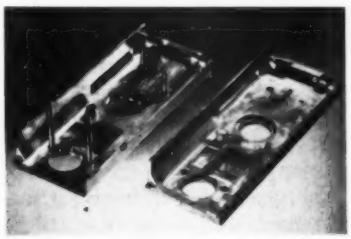
Three of the precision metal molding processes are used as a means of fabricating these difficult parts: die casting, investment cast-



STRONGER than a stamped front plate, this die cast zinc piece has the advantage of varying wall thickness which gives greater rigidity. It is one of the decorative, chrome plated die castings used on American Lockers.

ing and plaster mold casting. Three typical applications of these types of castings are illustrated on pages 32 and 33.

American Locker is not a newcomer to the use of these castings. In fact, we are among the pioneer users of die castings, having

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- Cutting Tool Costs
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••• In the production of intricate parts in all castable metals including Stainless, Alloy and Tool Steels, Armco Iron, Cobalt Alloys and Non-Ferrous Metals.

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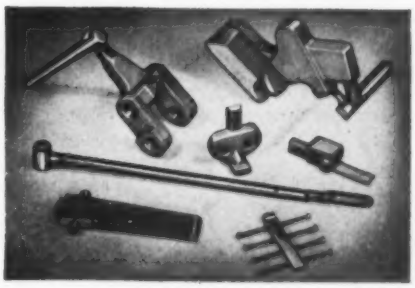
For additional information Circle No. 75 on the Reader Service Card

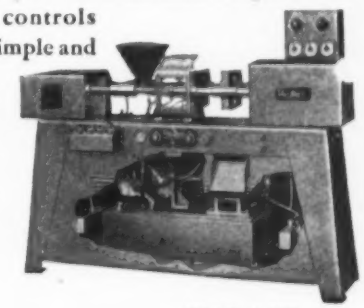
Investment Casters *Prefer* VAN DORNS for molding styrene patterns

Semi-Automatic Injection Press

Typical precision parts produced by investment casting, using styrene patterns molded to .003" tolerances on Van Dorn Presses.

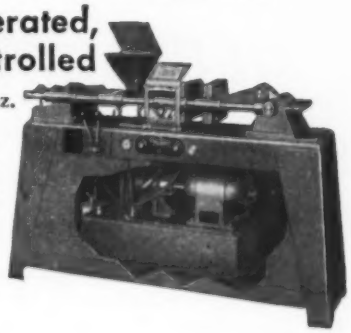


—2-oz. capacity. This ultra-modern press has push-button controls that are safe, simple and convenient. Accurate temperature regulation. Ruggedly built, compact and quiet.



MODEL H-200

Power-Operated, Lever-Controlled Presses — 2-oz. or 1-oz. models. Have many automatic and safety features.



MODEL H-200

Plastic Grinder — grinds up waste, rejects, etc., for re-use.

Mold Bases for these presses available from stock.

Write for information on this equipment.

MODEL G-100

THE VAN DORN IRON WORKS CO.

Cable Address: "VANDORN" Cleveland

2693 East 79th Street • Cleveland 4, Ohio, U.S.A.

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first introduced die cast zinc components in 1916. Since that time, the die castings in our production line have increased in number and complexity and include both structural and decorative pieces.

Plaster mold castings, likewise, go back many years. Here, too, we were among the early users of this more precise foundry technique for casting manganese bronze.

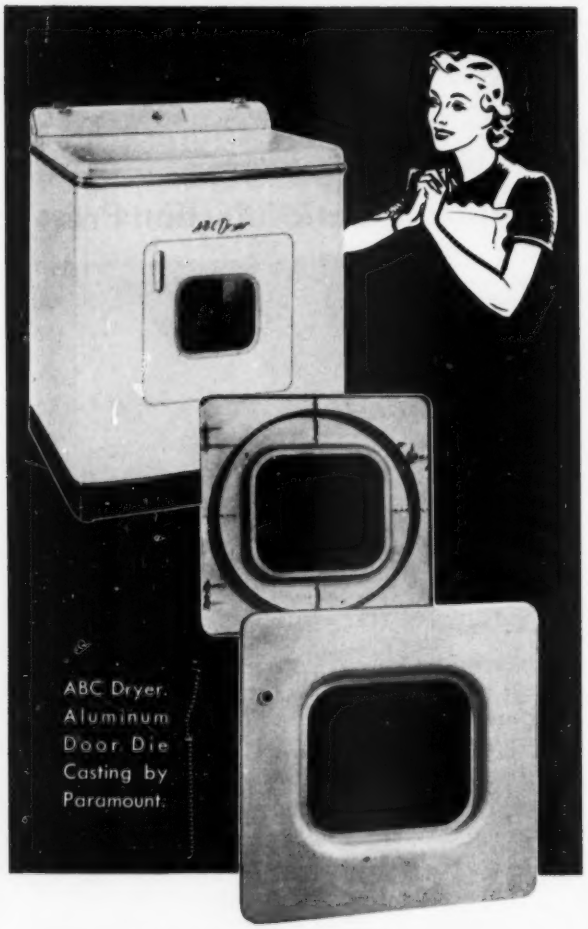
Investment castings are most recent to have been introduced, but are proving to be a most economical way of forming the latch casting described above, gaining the accuracy, clean detail and strength that are needed.

FURNACE DIVISION INCORPORATED

The furnace division of R-S Products Corporation announces its incorporation, and will be known in the future as R-S Furnace Corp., a subsidiary of Hardinge Co., Inc.

The new corporation will have D. E. Wyman as vice president, S. M. Stoler as assistant to the vice president, and F. L. Feldmeth as chief engineer.

The company will continue as specialists in custom built, field erected billet heating, forging and heat treating furnaces for both ferrous and non-ferrous metals.



PARAMOUNT

DIE CASTINGS . . . USED IN HOME APPLIANCES

An aluminum die casting meets all specifications for this ABC Dryer door. The smooth, easily finished casting is 16 3/8" square with 1/8" wall sections, weighs only 2.6 lbs. Paramount's die casting skill assures flatness necessary for perfect fit at all edges. Hinge mounting bosses, sealing ring and strengthening ribs are integrally cast, minimizing secondary operations. Paramount's complete engineering, die making and die casting facilities are at your service. We invite your inquiry. Descriptive literature available.

ALUMINUM AND ZINC DIE CASTINGS

PARAMOUNT

DIE CASTING COMPANY
ST. JOSEPH I, MICHIGAN

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IMS CONCENTRATED

SILICONE BOMB

MOLD LUBE

The Best Mold Release You Can Buy! Forms a "Slick Quick"!

UNDILUTED
ODORLESS
NON-TOXIC
SAFE

Dry Freon Propellent Protects Your Molds

PRICES:

Sample Can ... $ 2.00
Unbroken Dozen $18.00
(at $1.50 each)
Unbroken Gross $197.40
(at $1.37 each)

Further discounts on larger orders

INJECTION MOLDERS SUPPLY CO.

3514 LEE ROAD WYoming 1-1424 CLEVELAND 20, OHIO

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INDUSTRY NEWS

YALE & TOWNE EXPANDS POWDERED METAL FABRICATING

A new division of Yale & Towne Mfg. Co. — the Powdered Metal Products Division — has been established. This new division will consolidate the company's expanding operations in the powder metallurgy field.

According to Gilbert W. Chapman, president of Yale & Towne, the new division unifies under one management the recently acquired Powdered Metal Products Corp. of America, Franklin Park, Ill., and the American Sintered Alloys Division, Bethel, Conn., acquired by Yale & Towne in 1952.

George L. Bachner

George L. Bachner, formerly president of the Powdered Metal Products Corp. of America has been appointed general manager of the new division. Headquarters of the powdered metal products division will be at the Franklin Park, Ill.

LINDBERG EXPANDS FACILITIES

Lindberg Engineering Co., Chicago, has moved its Air & Hydraulic Division from the main plant to 225 N. Laflin Street, to increase manufacturing facilities for the production of air and hydraulic cylinders and related equipment. Additional personnel and machinery will result in quicker deliveries and improved service.

Expansion plans directed by L. A. Shea include the addition of new products to the present line of cylinders manufactured since 1943. New agents are being added to complete national sales coverage.

PERMOLD PRESIDENT TO SERVE NPA ALUMINUM DIVISION

Appointment of Everett G. Fahlman, president of The Permold Company, Medina, Ohio, as deputy director of the Aluminum Division was announced today by H. B. McCoy, acting administrator, National Production Authority, Department of Commerce.

Mr. Fahlman is on loan to the Government by his company under a rotation system by which the services of industries' experienced personnel are made available.

At the time of Mr. McCoy's announcement, The Permold Company announced the appointment of John E. Fahlman as acting general manager.

MERCAST LICENSEE ANNOUNCED

The Industrial Metal Castings Co., Cleveland, Ohio, has been licensed to produce investment castings by the frozen mercury pattern method according to the Mercast Corp., holders of the basic patents.

Other licensees under Mercast patents are: Thompson Products Inc., Alloy Precision Casting Co., and Kohlcast Industries, Inc., all of Cleveland, Ohio.

At the same time the parent company announced that L. Boyd Hatch, executive vice-president of Atlas Corp., was elected a director of the Mercast Corp.

Certified Alloys Opens West Coast Plant for Zinc Die Casting Alloys

The Certified Alloys Co., of Bedford, Ohio, national producer of Zamak zinc die casting alloys announces the opening of a new and modern alloying plant in the Los Angeles industrial area.

H. H. Barnett, president of Certified Alloys Co., declared that the new plant was built to enable Certified to provide prompt service on zinc ingots to industrial users on the West Coast.

The new plant, located at 9323 Bermudez St., Rivera, Calif., will house the company's production, research, sales and administrative departments. The new plant is equipped with modern production facilities.

The plant's operations will be directed by John Sellon who has had over 30 years of administrative, production and engineering experience with a prime zinc producer. Prior to his new assignment, he headed the Zinc Division of the N. P. A. from his office in Washington, D. C.

TAILOR-MADE METALS
continued from page 36

is superior in radiation shielding ability.

It therefore not only will meet the need for compact heavy masses in flywheels and counterweights in machinery, but will also be of great value in this age of nuclear fission and radioactive materials.

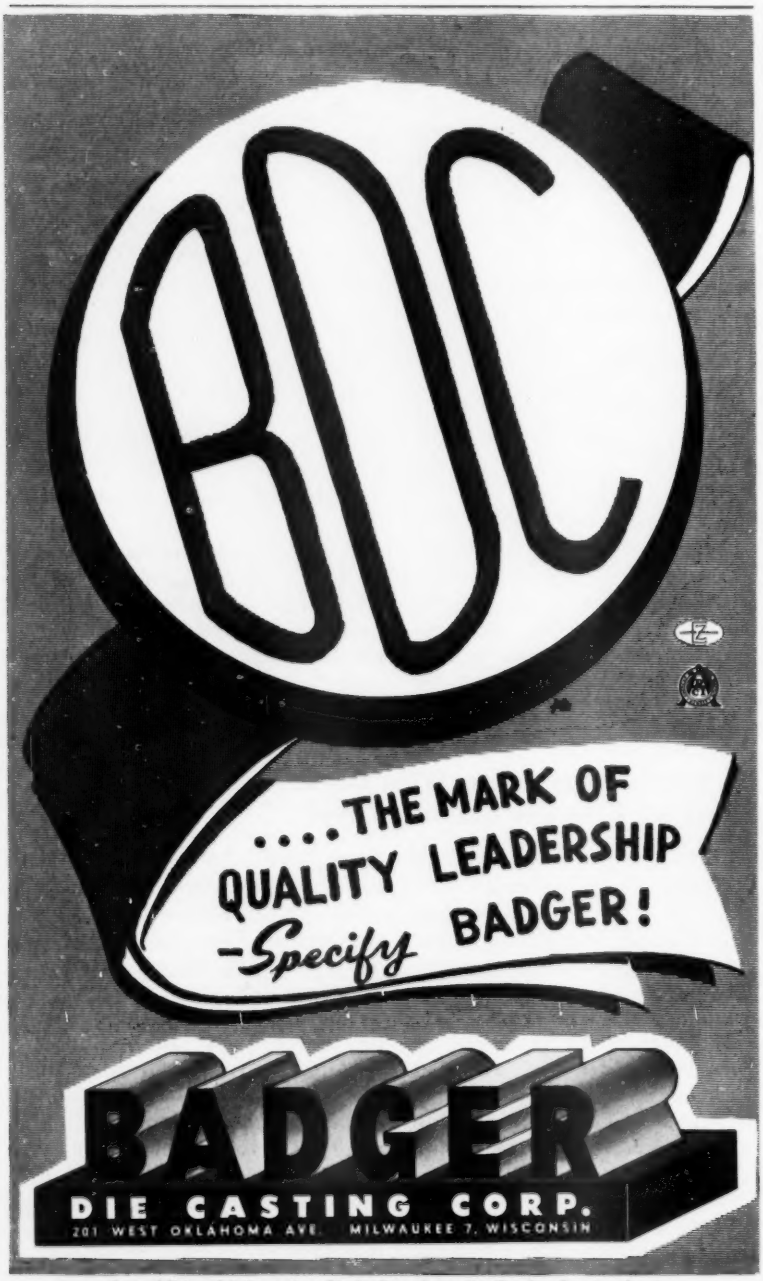
Metals created by the powder process can be altered within limits by changing ingredients, ingredient proportions, sintering processes and shape of the product. This is an advantage since specific properties can be developed in the engineering appraisal stage to meet the needs of designers.

It is well known that any metal created for a specialized application in small quantities is not inexpensive. But when a special metal reaches acceptance as an engineering material because it meets a specific need, it can then be placed on a mass production basis. When produced in this manner, its cost is considerably reduced.

When standards are developed so that many specials do not have to be made to meet the needs of most of the production, cost can be further lowered. It is a fact that today a carbide tipped lathe tool costs no more than a similar shaped high speed steel lathe tool in many sizes.

With the age of high speed and atomic energy already with us, it is evident that we must develop new specialized materials to meet the needs of radically new equipment. Extremely high temperatures, high pressures, high speeds and high loads are in the future. Actual figures for these factors indicate that they are far beyond those that can be met by conventional metals.

At a time when we are in an arms race with a determined adversary, specialized metal development must continue at an accelerated pace. From our experience in the last five years, we haven't scratched the surface in what can be created by the powder metallurgy process alone.



For additional information Circle No. 46 on the Reader Service Card

SINTERING
continued from page 46

ruined by an inadequate or improperly functioning pre-heat zones than by any other single furnacing operation.

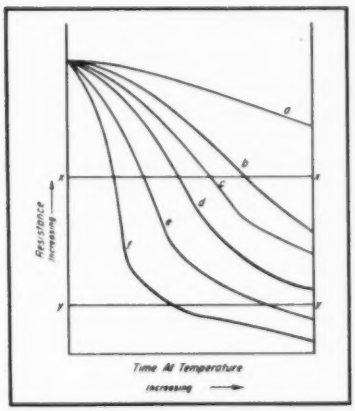
SINTERING ZONE

By the time the compact has passed through the pre-heat zone it is assumed that all of the lubricant and any addit-

ives have been volatilized. All of the entrapped air should have been replaced with reducing gases and all or nearly all of the metal oxides should have been reduced. Assuming that these conditions have been met and that the compact has been heated to nearly the sintering temperature the function of the sintering zone becomes simple.

Previously (see Part 1 of this article) it was shown that for a given compact the degree of homogeniety is determined by the sintering temperature and the time at that temperature. The sintering zone of the furnace is, therefore, simply a constant temperature oven through which the compacts are moved at such a rate that the desired time at temperature is secured.

If, for example, the final properties of a compact are measured by the electrical resistance (any other convenient method can also be used) then it is possible to produce a family of curves showing the



8. Empirical relationship between sintering time and electrical resistance for metal powder compacts sintered at varying temperatures.

relationship of resistance to time for a series of different temperatures. Such a family of curves is shown in Figure 8. At the start all of the green compacts have very high resistance and in fact, resemble semi-conductors rather than metallic conductors. As the compacts are sintered for longer and longer periods of time at constant temperature the resistance decreases as shown. The higher the temprature the lower will be the resistance after the same length of time. In the figure curve "a" represents the lowest sintering temperature considered while curve "f" is the highest.

Assuming now that the final properties of a compact are represented by the line x-x then all temperatures from "b" to "f" inclusive would give this value within the times covered by the chart. Temperature "a" would never give this low a value. If on the other hand, the final properties are represented by y-y, then in the same interval only

continued next page

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ALUMINUM INGOT
Brass Ingot
Bronze Ingot
To Your Specifications!
A Holtzman certificate of analysis is your guarantee of just the right ingot to meet your needs. Complete, modern testing laboratories assure HOLMCO products meet the most rigid chemical and physical specifications.
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temperatures represented by curves "e" and "f" would give the desired end product.

The choice of which temperature and what time to use will depend on the furnace. If the compacts are in the lower melting metals or alloys such as copper or brass, then almost any commercial furnace will give as high a temperature as can be used, since too high a sintering temperature can be used, since too high a sintering temperature can cause softening to the extent of deformation. It is therefore only necessary to determine the maximum economical operating temperature and to move the compacts through the furnace at such a rate that the final compact has the mechanical properties desired.

If, however, a ferrous base metal is being sintered then the materials of construction of the furnace and the type of heating elements employed will affect the choice of both time and temperature for sintering.

In order to maintain the high purity atmosphere that is necessary for proper sintering, practically every furnace is equipped with a metal muffle. A wide variety of metals have been tried for muffle material including pure iron, pure nickel, various stainless steels, inconel, and some others. The muffles have been fabricated by forming and welding plate stock and by casting. Regardless of the material used or the method of fabrication the maximum economical operating temperature that has been economically used thus far is from 2200F to 2250F. At these temperatures muffle life due to oxidation is short unless a protective atmosphere is used both inside and outside of the furnace. Furnace loads must be light and the muffle roof must be well supported to prevent sagging.

These high temperatures are, possible only when special metallic heating elements such as molybdenum or tungsten are used, neither of which is commercially practical, or when the non-metallic type of elements are used such as Globar elements. These latter type of heating elements are silicon carbide and are capable of operating continuously in either air or a protective atmosphere at temperatures up to 2800F or slightly higher. At any temperature useable with a metal muffle these elements can be operated successfully at a loading of up to 22 watts per square inch.

With metallic type of heating elements the top operating temperature, in a protective atmosphere, is under 2200F and for operation in air, if reasonable life is to be

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Die Castings
Preferred WHEN ONLY
THE BEST IS GOOD ENOUGH
There must be a reason why so many highly discriminating manufacturers entrust all of their work to us. The reason is they know from experience that the finished job will meet every specification as to appearance, strength, accuracy and function. Furthermore, the price on either long or short runs is in line with their production and selling costs.
If you are located west of the Mississippi River we are in an excellent position to take care of your die casting requirements. Quotations made promptly.
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DIE CASTING COMPANY
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For additional information Circle No. 57 on the Reader Service Card

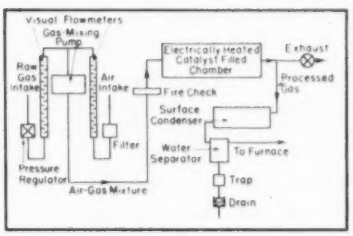
secured, the maximum temperature is about 1850F. In either case a loading of about 5 watts per square inch is considered maximum.

It is probable that the widespread use of metallic heating elements more than any other single factor is responsible for the use of 2050F as the sintering temperature for iron base compacts.

Other factors which must be considered as they affect the sintering zone are the ability to cycle the furnace through a temperature cycle, the ease of changing temperature, the effect of element burn-out on production and certain other factors. With the possible exception of first cost, most of the conditions which make for efficient operation and good control of the sintering zone favor the non-metallic type of elements.

THE COOLING ZONE

The cooling zone of the furnace needs little discussion. Its function is obvious: to lower the temperature of the compacts to the temperature



9. Schematic diagram of typical generator for producing a controlled atmosphere for sintering. (Courtesy Westinghouse Electric Corp.)

at which they may be discharged from the furnace without oxidation. The only factor which must be watched is that oxidation of the compact does not occur during cooling. This is a function of the furnace atmosphere.

Few other factors need to be considered in the design of a sintering furnace. The load per square inch of muffle floor, (or of chain belt in that type) is lower than for a standard heat treating furnace. This is due in part to the lower density of the compacts as compared with wrought metal and in part to the fact that the vertical height of a single piece is not as great.

Further, powder parts prior to sintering are fragile and must be carefully placed on either the chain belt or on trays, this generally results in wider spacing between parts than would be the case with wrought parts. This factor of lower unit loading allows wider and lower muffles than other types of furnaces. In general the ability to design a muffle roof that will not sag is the limiting factor in width.

The difference in specific heat of a green compact as compared with a piece of wrought metal requires a somewhat longer time for the same mass to reach the same temperature.

continued next page

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ZINC AND ALUMINUM DIE CASTING
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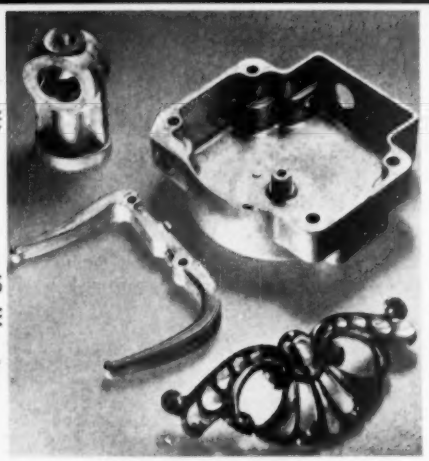

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Above all, the multitude of functions which the pre-heat zone must accomplish usually necessitates a longer than usual pre-heat zone.

Auxiliary equipment such as furnace generators and temperature controls, to mention only two, will be dictated by the furnace design, the work to be done, the furnace capacity, etc. This auxiliary equipment is often selected on the basis of personal prejudice subject, of course, to determination by the furnace builder that the equipment selected will do the job in or on his furnace.

SHORTEST ROUTE
continued from page 31

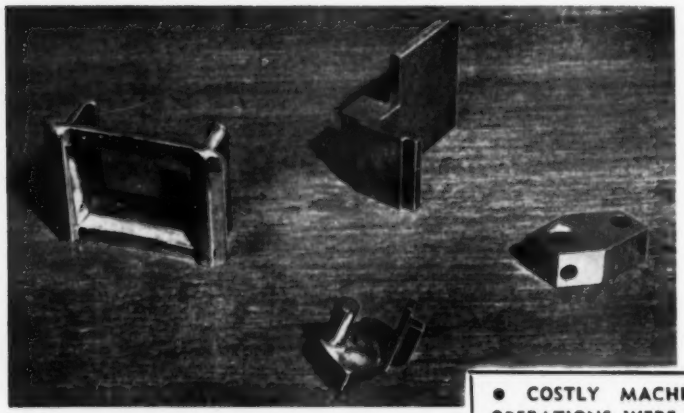
heavy flash. No holes were cast-in and all backs were made flat, nor were the grooves between the rows of bristles cored.

After the rough casting was received the entire outside had to be machined to remove excess metal and to bring the piece to its proper size. Following this the grooves, from five to seven of them, were cut with a thin saw mounted in a milling machine. Where necessary, the back was then curved in coining dies and the handle curved if desired.

Next came hole drilling — generally one hole was drilled at a time and then countersunk. Finally, the brush back was ground, first on a 150 emery wheel and then on a 180 emery wheel, buffed to give a lustrous surface.

Contrast this slow and expensive procedure with modern methods.

The back is produced as an aluminum die casting with all



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of the necessary ridges, grooves and holes cast-in. The production dies are, of course curved to give both the back and the handle the proper shape and the part, as delivered by the die caster, is complete except for a final polish.

Die casting dies are expensive so that it becomes desirable to utilize them to the utmost. A saving in die costs has been accomplished by building the brush back dies in such a manner that the handle can be blanked off with an insert. The resulting rectangular die is then used for the complete line of hand or military brushes having aluminum backs.

The reduction in manufacturing cost made by the use of die castings cannot be determined since the highly varying cost of producing sand castings over the past several years makes accurate estimating at today's costs virtually impossible. As nearly as can be determined, however, the die cast brush back, ready for bristling, costs about one-fourth as much as a comparable part starting as a sand casting would cost.

Final results: Hygenia die cast aluminum hair brush backs meet all requirements for durability and sanitation. The one-piece, silver-bright polished aluminum backs can be repeatedly sterilized, thus meeting state laws affecting barbers and hair dressers. Cleaning of the brushes is expedited by means of the full-length slots cored into the brush backs.

H. M. REED DIES

Harry Merrick Reed, a member of the Board of Directors of Vanadium-Alloys Steel Co. and secretary of both Vanadium-Alloys and its subsidiary, Anchor Drawn Steel Co., died at his home on Saturday, Sept. 5th, after an illness of several months.

LAVIN BUYS L. A. COHN

Announcement was recently made that R. Lavin & Sons, Inc. had purchased the entire inventory and physical assets of L. A. Cohn & Bros., Inc. This merger of the two companies will enable R. Lavin & Sons to supply customers with a complete line of non-ferrous metals. Both secondary and primary metals will be available in brass, bronze, aluminum, copper anodes, babbit and zinc alloys for die casting.

Both companies have been in buisness for approximately 50 years.

Cohn personnel who will transfer to Lavin are: Max S. Cohn, Marvin M. Cohn, H. H. Klein, Carl Karna, and George K. Schmitt.

Both the Chicago and North Chicago plants will continue to be operated and an additional eastern plant will be started if present negotiations are successful.

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SIMPLIFIED SOLUTIONS

for production problems

POSSESSING all of the flexibility of coring of a green sand mold and with the added advantages of greater accuracy, better surface on the casting and, to a great degree, self supported cores; the shell molding process is uniquely adapted to the manufacture of such products as the air tool handle illustrated.

Made as a one piece casting, the shell molded part has eliminated the use of loose sand cores used in the previous method of manufacture. This has resulted in not having a solid exterior surface where before there were two holes from core supports that had to be plugged.

With the new method of fabrication, the air channels are smoother and cleaner. Finish machining has been greatly reduced and the exterior needs practically no surface finishing. The casting is made by Olson Pattern & Foundry Co.

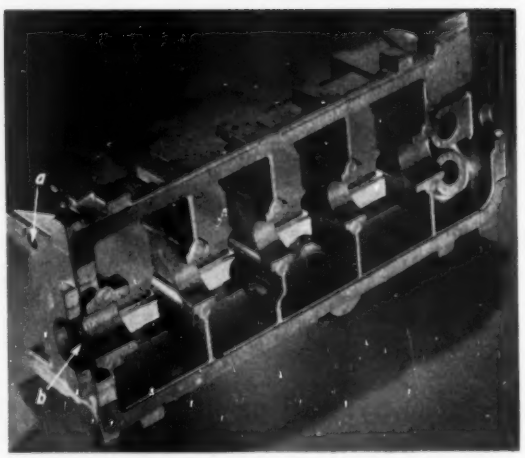
COMBINATION OF METAL INSERTS and loose sand cores in a steel mold give the permanent mold casting process a flexibility not available by any other process. Intricate shapes that would be difficult production problems can often be produced this way.

The crank case casting shown here illustrates this combination of metal and sand cores in a single, large casting. It is used on a small, four cylinder gasoline engine, and is cast in aluminum alloy by Ebaloy Foundries, Inc.

An unusual feature is indicated at "a" in the photo. Arrow indicates one end of an oil line formed by a seamless aluminum tube cast as an insert in the crank case. The tube runs the entire length of the casting and is open at both ends.

Loose sand cores are used to produce the undercut indicated by "b".

Dimensions of the casting are approximately 17¼" x 7" x 3" and the finished casting weighs more than 9½ pounds. It represents an excellent example of the flexibility of the permanent mold casting process.



MELTING PRACTICE
continued from page 41

losses in melting, then these should be made after the metal has been deoxidied by the use of either zinc or phosphorus in order that the fresh tin and lead being added shall not be oxidized itself by the oxide content of the metal.

It should be kept in mind that not only phosphorus but also other elements, and particularly gases, have an effect on the fluidity of the copper-base alloys. Phosphorus tends to increase fluidity materially, whereas gases tend to cause the metal to be somewhat sluggish.

For iron-base alloys (steels), the deoxidizing is usually with silicon or aluminum or both. Sometimes manganese is also

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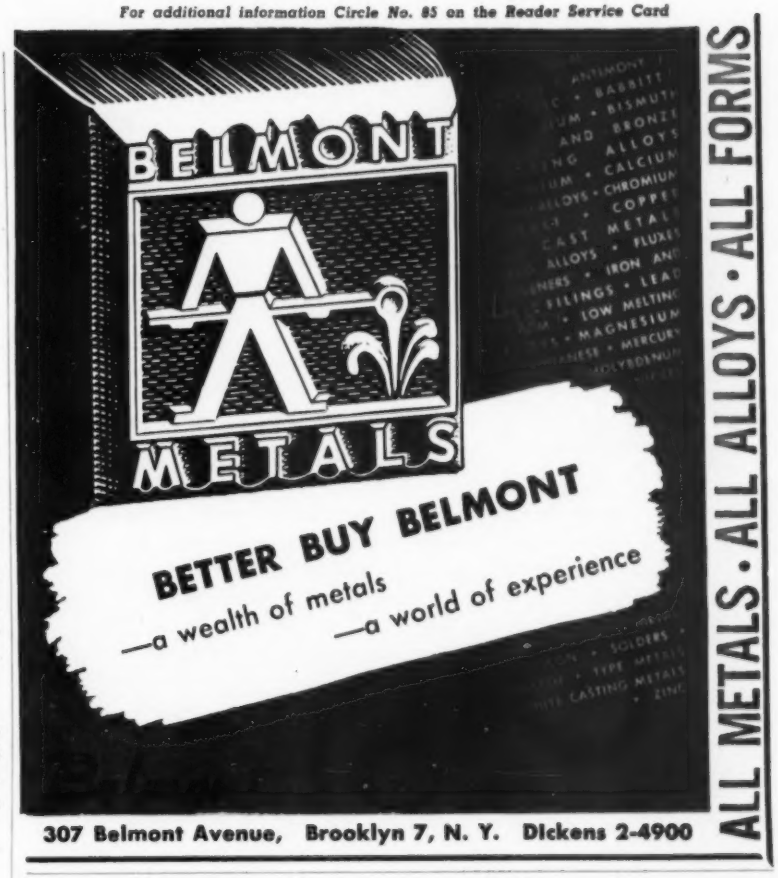

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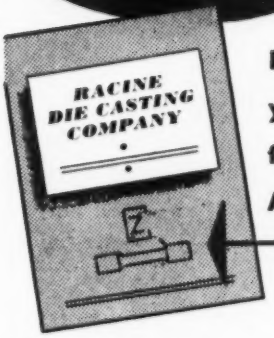

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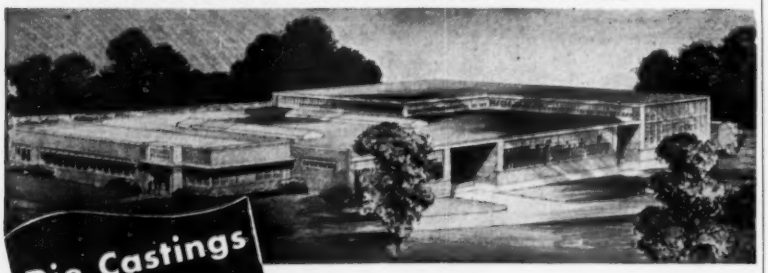

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used for this purpose. The nature of the alloy being made is the controlling factor.

For nickel-base alloys, the deoxidizing is usually with magnesium or manganese or both.

For cobalt-base alloys, the deoxidizing is usually with silicon. As in the case of steels, the nature of the alloy being made is the controlling factor.

Whether charges have been calculated correctly, whether weighings have been made correctly, whether all parts of the charge have been added to the melt, whether proper additions to correct for losses have been made, can only be shown by chemical analysis of metal as poured into castings.

Regular periodic chemical analysis are an indispensable guide for good practice.

Refractories and crucibles

For crucible furnaces using oil or gas, the linings are usually made from common fire brick, silicon carbide forms or

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from a rammed plastic mixture The plastic mixtures often contain a considerable proportion of silicon carbide. With good practice 1200 to 1500 heats should be obtained before a new lining is necessary.

For indirect arc electric furnaces, refractories containing high percentages of silicon carbide or sillimanite are used, being backed up with added heat insulation. In most shops a high-grade diaspor brick is used. Good practice should enable one to get 100 to 150 heats before relining.

Crucibles are used in both fuel-fired and high frequency induction furnaces. Crucibles are often a considerable item of cost. The storing and handling of crucibles to protect them from moisture is all-important if good crucible life is to be obtained.

Crucibles should be stored in warm, dry places. They should never be stored on damp ground. If crucibles once become wet, they should be dried out very slowly and very carefully. Several days drying at around 200 to 250 F. is preferable. Even a thoroughly dry crucible should be heated slowly for the first heat. Before any charge is put into a new crucible, the crucible should be put in a cold furnace and slowly heated up to a dull red heat.

Most fixtures (charcoal is not considered a flux) have a tendency to attack the crucible. Some fluxes are much more active in this regard than others. Fluxes of a high lime content or of a high borax content are particularly active in their attack on crucibles. For this reason, if for no other, fluxes should be avoided as much as possible.

Under no conditions should a crucible of molten metal be allowed to cool down to the point where the metal freezes in the crucible. Any molten metal remaining in a crucible should be poured out and any slag or encrustations on the crucible should be cleaned off while the crucible is still hot.

Melting temperatures

In spite of careful selection of raw materials, careful and proper melting, it is not possible to obtain satisfactory castings if temperatures are not held within reasonable limits for the alloy and for the casting to be made and if the pouring operation is not carried out carefully. Temperature control applies not only to the temperature to which the metal is heated in the furnace but the temperature at which the metal enters the mold.

A distinction should be made between melting temperatures and pouring temperatures. Melting temperatures affect the quality of the metal itself and if excessive will harm this quality. Pouring temperatures

continued next page

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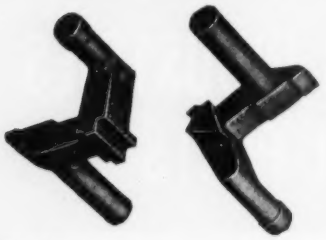

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control whether the metal properly fills the mold and produces the desired shape and finish on the casting.

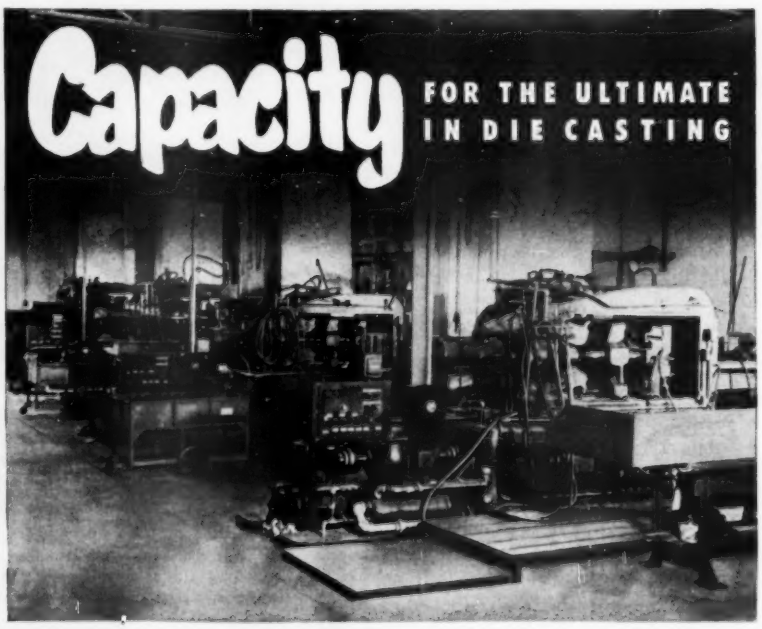
For the aluminum, magnesium and copper base alloys, the temperatures of molten metal are best determined by using an immersion type thermocouple either of the open end or closed end variety with a suitable meter.

The closed end variety of thermocouple may be either of the bare couple type or of the enclosed couple type. Quicker response and, therefore, quicker readings are obtained by the use of the bare couple types. Some prefer the open end type of base metal thermocouple to the closed end type because of the difficulty of obtaining very long life of the closed end which is in contact with the molten metal.

The smaller the gauge of the thermocouple wire which is inserted into the molten metal, the quicker does it come up to temperature and the quicker temperature readings can be made. In obtaining this greater speed of response, however, the life of the thermocouple wire is decreased.

Bare metal thermocouples from the extreme of fine wire couples suitable for only one or two temperature measurements on copper-base alloys to No. 6 gauge wires are available on the market. Most of the portable meters used with these bare couple immersion pyrometers are of the rugged low resistance type.

One instrument has a push button arrangement on it operated by the thumb which makes it possible to immerse the thermocouple in the molten metal, release the pressure of the thumb on the button and step away and make the reading from the meter.



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This instrument also permits of the operator watching the thermocouple in the metal during the immersion period rather than watching the meter.

For the high temperature alloys, the immersion type thermocouple pyrometers are not suitable. Optical pyrometers of the incandescent filament type are used.

In indirect arc furnaces with frequent rocking of the melting crucible, there is little difference between wall and metal temperatures and sighting on the refractory gives nearly perfect "black body" conditions. This is preferable to sighting on the bath itself, which, when near casting temperature, acts as a mirror to reflect the electrodes and arc. By prefocusing, the temperature can be recorded a few seconds after cutting off the power, thus avoiding the errors of arc reflection, flare etc. Power is quickly reestablished so that very little drop in temperature occurs in well insulated shells.

Temperatures may be recorded considerably higher than the melt if care is not taken to avoid the errors described above, and a reasonable amount of skill, judgment and common sense must be used and casting machine operators carefully trained in the proper technique for reading temperatures.

With high frequency induction melting, the optical pyrometer is focused on the surface of the molten metal while the power is on. The eddy current stirring of the metal which takes place in the crucible during high frequency induction heating yields a continuously clean molten metal surface. However, the clean surface of a molten metal may have as low an emissivity factor as 0.07 for silver. For molten copper, the factor is 0.15. For steel the factor is 0.40. If the pyrometer is calibrated in terms of an emissivity factor of 1 (black body condition), the surface of a molten metal will appear to have a much lower temperature than really exists.

Emissivity factors for only a few pure metals have been determined. Factors for alloys are practically unknown. However, if a clean metal surface can be observed consistently through a clear atmosphere, the readings of an optical pyrometer can be used to maintain and reproduce temperatures that have been found to be satisfactory even if the true temperature is not known. The bath is brought to a temperature that experience has shown gives a certain reading on the pyrometer and that is satisfactory for the casting.

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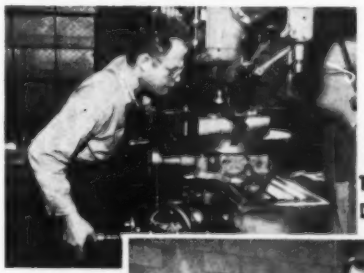
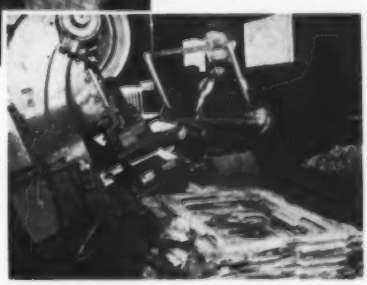


To the Die Casting

To the Finished Castings of Zinc or Aluminum



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NON-FLAMMABLE, water-base hydraulic fluids are being used in this die casting machine in operation at Sterling Die Casting Co.

Nine steps to drain and flush the hydraulic system of a die casting machine and refill it with water-base fluid are presented here.

How to use
Non-Flammable Water-Base Hydraulic Fluids

THE rising incidence of industrial fires and explosions springing from hydraulic installations has caused considerable alarm in die casting plants and others using hydraulically-operated equipment in the vicinity of flame or high heat. Higher pressures and a widening range of hydraulic applications have magnified the hazard of using flammable hydraulic oils.

When this new non-flammable water-base hydraulic fluid was announced last month, the editors of PMM asked the manufacturer to tell us how this fluid performs in die casting machines and how to use it. Here is a report.

A report of the National Fire Protection Association shows that at least eleven fires were caused by flammable hydraulic fluids in recent years, two of them causing a staggering loss of nearly one million dollars each. Both were caused by fluid that ignited after a break in the hydraulic line.

This constant danger of fire accelerated the search for a non-flammable synthetic fluid that would combine maximum fire resistance with top hydraulic efficiency. It was relatively simple to develop fluids which would not burn. But the real problem was to impart properties to such fluids which would prevent undue wear and enable the non-flammable material to function as effectively as did the better types of petroleum base oil widely used as the hydraulic medium.

Significant advances have been made in the development of non-flammable fluids with bases of phosphate ester compounds and halogenated fluids.

Water-base hydraulic fluids are said to have come closest to meeting the threat of fire, but the inherent weaknesses of water first had to be overcome with additives before it could do the same job as the conventional hydraulic oils. One advantage of water is its low cost wherever leakage or disposal rates are high.

Now a water-base synthetic fluid has been announced that is reported not only to resist fires and explosions, but also to offer a high viscosity index, good lubricity characteristics and long-term stability. The ideal water-base fluid must protect the hydraulic system against rust and corrosion, have a low pour point and

possess enough film strength to prevent undue wear on precision pump parts. It should also be non-toxic, non-corrosive, non-foaming and safe for packings.

Water-base synthetic fluids cost more than straight hydraulic oils because of the higher cost of raw materials and complex manufacturing processes. When first introduced, this price differential was much greater than it is today, as volume production of these fluids progresses. But despite the original difference in cost, it is more than worthwhile in the long run considering the terrible loss in life and equipment spared by using non-flammable fluids. The fortified water-base fluids can be used with a feeling of safety in the vicinity of any source of flame or intense heat.

Much has been learned regarding the use of water-base fluids as a result of extensive field and laboratory testing. E. F. Houghton & Co., of Philadelphia, has uncovered a considerable amount of application data in its five-year development of a new water-base non-flammable hydraulic fluid known as Houghto-Safe. This fluid has been rated "an acceptable hydraulic fluid from the fire hazard standpoint" by the Factory Mutual Engineering Division of Associated Mutual Fire Insurance Companies, after rigid testing by that organization.

Draining and flushing

It is very important that systems be thoroughly clean before filling with a synthetic water-base hydraulic fluid. The following procedure, for example, is followed in the use of Houghto-Safe:

1. Set the relief valve at 50 pounds pressure before draining the machine.
2. Drain the reservoir of all fluid, making sure sludge is cleaned from the reservoir, empty lines, cylinders, accumulators, coolers, etc., during the draining process.
3. Disconnect or remove the filter.
4. For positive flush, fill the machine with a flushing concentrate diluted with water.
5. Operate the machine for about 15 minutes, allowing it to complete all motions repeatedly. This is particularly necessary when replacing other non-flammable type fluids. If water is used alone, it may be well to flush several times to remove all remaining traces of the fluid previously used.
6. Drain completely as outlined in No. 2 above. Wipe reservoir dry.
7. Install new or clean filter. Do not use Fuller's Earth or similar diatomaceous earth.
8. Add the non-flammable water-base fluid to the system.
9. Reset the relief valve to the proper operating pressure. If, after running with a water-base fluid and following a period of rest, the reservoir contents begin to separate because of presence of contaminants, the foreign material should be removed at intervals until completely eliminated. Depending upon its gravity, this material will either be on the surface, as in the case of petroleum oil, or

continued next page

Two basic requirements for hydraulic fluids in die casting machines

FIRE HAZARD is great where hydraulic fluids are used in the vicinity of hot metal, such as in the case of this die casting machine. Therefore, fire resistance is an important requirement. In addition, this die casting company reports that water-base fluids give off no noxious odors.

WEAR on pump vane edges will result when the film strength of the hydraulic fluid is too low. Wearing edge is pointed out here. Lubricating quality of the fluid is equally as significant as is its ability to withstand fire. These pump vanes have been checked by weighing to indicate negligible rate of wear.

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NON-FLAMMABLE — cont.

will drop to the bottom, as with phosphate type fluids. In the former case, it may be skimmed off. In the latter, it can be removed with a suction gun.

Sampling

Samples should be removed for visual inspection as well as determination of viscosity and pH values after the first 48 hours of operation. These samples should be sent through the same channels as used for regular field sample analysis. The check can be made by the user company's own lubrication engineer or by the firm supplying the fluid, providing it offers this service. Such a measure insures additional safety and maximum operating efficiency.

Water content

A water-base hydraulic fluid naturally depends for its non-flammability on the water it contains. If the water content is depleted, the fluid's fire protective properties are removed. For this reason, as well as in the interest of maintaining correct fluidity for proper functioning, it is essential to check the viscosity periodically (depending on sump temperatures) and add water in amounts based on the increase in viscosity that has occurred in use. Users of Houghto-Safe, for example, are told they should not permit this fluid to exceed 250 seconds at 100F viscosity. This will insure non-flammability characteristics and also give better hydraulic operation.

In general, it is recommended that reservoir temperatures be maintained under 130F although most water-base fluids will function satisfactorily at higher levels. It has been found that where water-base hydraulic fluids have replaced fluids of petroleum nature, the reservoir temperature has dropped materially due to the greater ability

of the water-base fluid to conduct heat to the outer reservoir walls.

Chart No. 1 denotes the amount of water to add for varying viscosity values. Use either distilled or deionized water such as boiler feed water. Tap water may be used but it is not recommended because of its possible hardness.

Control of pH value

The pH value should be maintained between 7.5 and 8.5. This indicates the adequacy of certain ingredients in the fluid which impart its unique qualities. A variation beyond or below the above values would be a sign of deterioration.

Producers or suppliers of these synthetic water-base hydraulic fluids may determine the pH values of initial user samples. However, the user

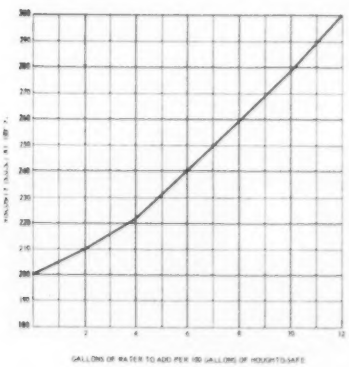

CHART 1

Water make-up chart for maintaining Houghto-Safe hydraulic systems.

may check periodically himself, using Hydrion papers available from any chemical supply house.

Film strength

Years of laboratory research indicated that additive treatment would be required to produce a water-base fluid that would reduce pump wear and provide greater lubricity. After such treatment it was found that the weight loss for the 12 vanes of a V-200 type pump (1000 psi) was only two milligrams per hundred hours. Total weight of the vanes

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NON-FLAMMABLE — cont.

when new is about 36,000 milligrams.

On that basis a "safe" fluid thus fortified by film-strength additives will protect a pump for 80,000 hours, allowing a maximum of 5 percent wear. This is practically the life of the pump. In exhaustive pump tests, this particular water-base fluid has proved that it can lubricate on a par with high-grade petroleum oils.

Where to use

Applications for a non-flammable fluid are rapidly expanding. In addition to use with die casting machines, the right type of fluids hold promise for applications with hydraulic foundry equipment, coke oven door closers, hydraulic forging presses, ingot manipulators, fork lift trucks operating near furnaces, etc.

Film strength tests have shown that certain water-base hydraulic fluids, when fortified by an extreme-pressure additive, will carry up to 2½ times the load of convention-

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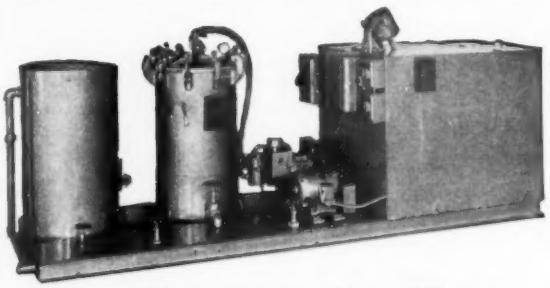

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al hydraulic oils of similar viscosity. When properly manufactured, they will resist separation or breakdown under increased pressures. Tests indicate excellent performance at pressures of 1000 psi.

In conclusion, observing the following do's and dont's outlined by the manufacturer will result in greater safety and more efficient use of water-base hydraulic fluids such as the type described herein:

1. Keep the reservoir temperature below 150F.
2. Maintain viscosity below 250 S. U. V. @ 100F.
3. Consult Chart No. 1 for amount of water to be added to adjust viscosity. Use distilled water or boiler feed water.
4. Do not add other fluids or oils to systems using this water-base fluid.
5. Do not use Fuller's earth or other clay type filters.

METAL POWDER
continued from page 52

capacity, however, is intended to replace imported material.

Most industries, when they become big enough today, join together in trade associations to work out the problems that are mutually troublesome. Some ten years ago a small group of companies in this industry took that step and formed the Metal Powder Association. Today there are more than 50 companies represented in that Association.

EIGHT FACTS
continued from page 47

f. Cost of jigs and fixtures.
g. Cost of tooling to finish machine the castings.

continued next page

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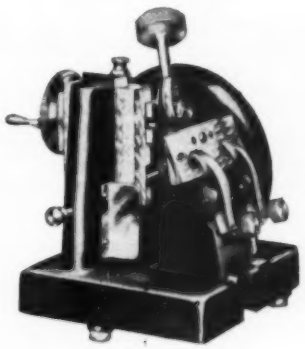

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h. Cost of preparation of surface for finishing.

When all of these factors were considered for the brackets shown, permanent mold casting was chosen as the best fabricating method. For these parts, the casting methods considered were: Sand casting, Permanent mold casting, Die casting. (Shell molding was not considered since the art was not sufficiently advanced at the time the decision had to be made. Re-evaluation has not been attempted since.)

From the tabulated comparison it is evident that sand casting has an over-all high cost for these parts. Of the two remaining methods, permanent mold and die casting, the choice of permanent mold casting was made because the number of duplicate parts was not sufficient to amortize the first tooling costs at as low a level by die casting as by permanent mold casting. This is true in spite of the fact that the rough casting cost for a die would be somewhat lower.

Considering for a comparison, then, only sand casting and permanent mold casting it was determined that the cost of a finished casting ready for anodizing (this is done for corrosion protection only) was at least 50 percent lower for a permanent mold casting.

In addition, production department estimates indicated that the tooling costs, including jigs and fixtures, would be from 30 to 40 percent lower for a permanent mold casting.

In finishing these castings some holes must be bored since that operation was cheaper than coring the casting. There are also a few milling operations that would have been required regardless of the method of casting used. A further point of interest is that of all the methods of casting considered only sand casting would have required any surface preparation prior to anodizing.

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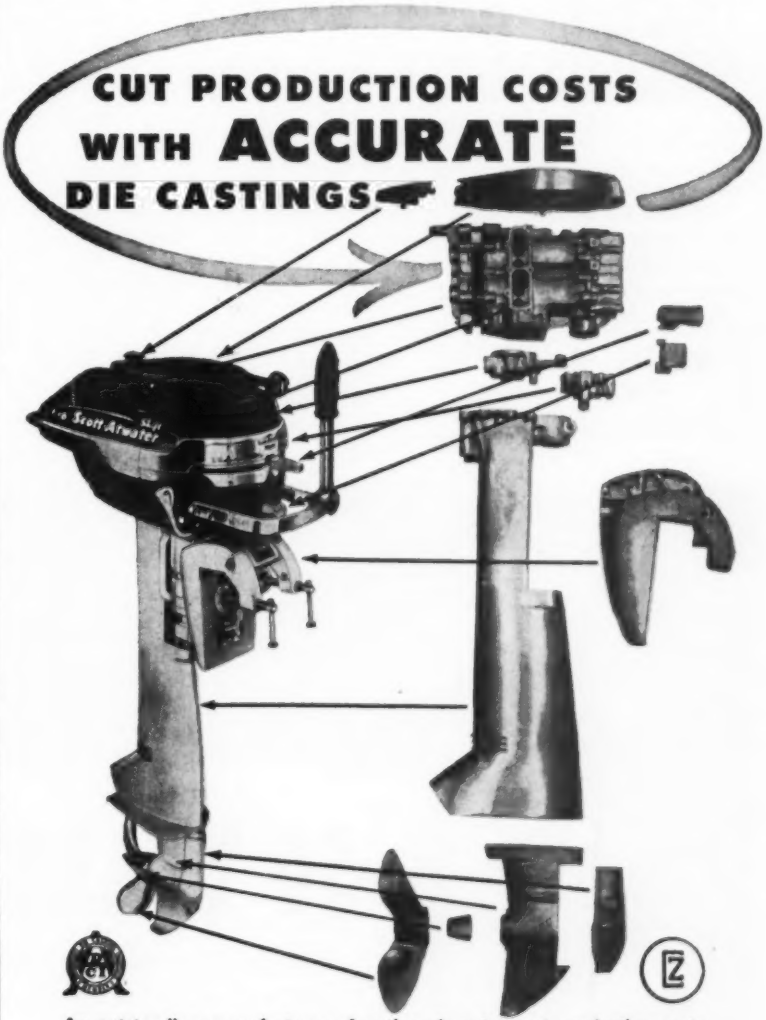

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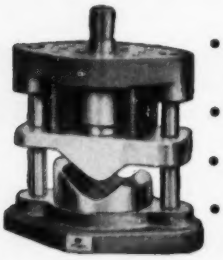

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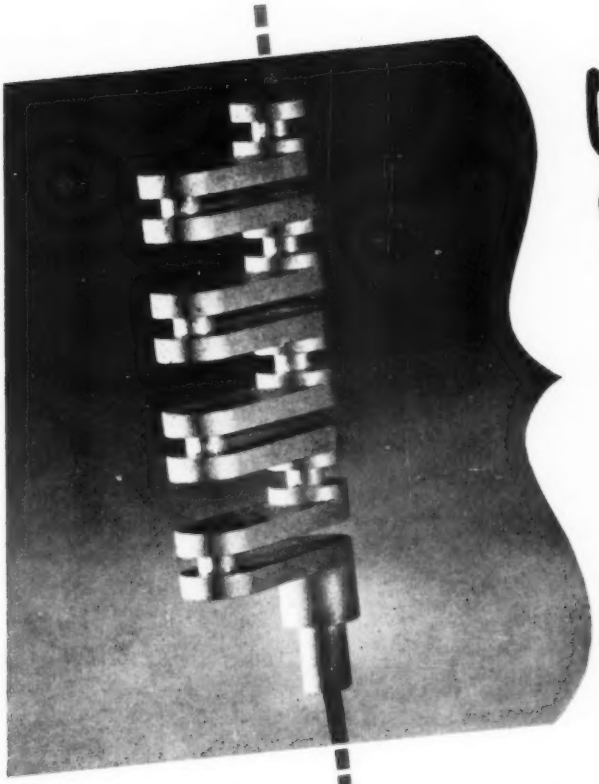

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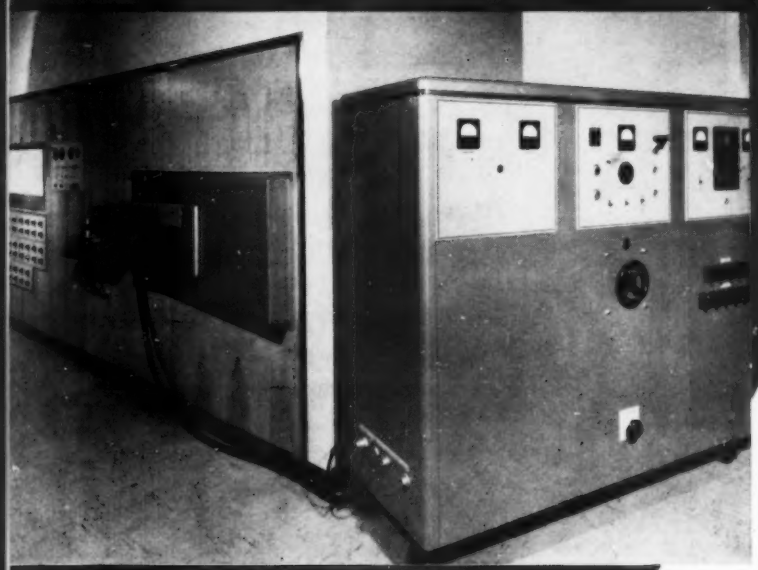

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